THE MICRO WORKS

80C DISASSEMBLER
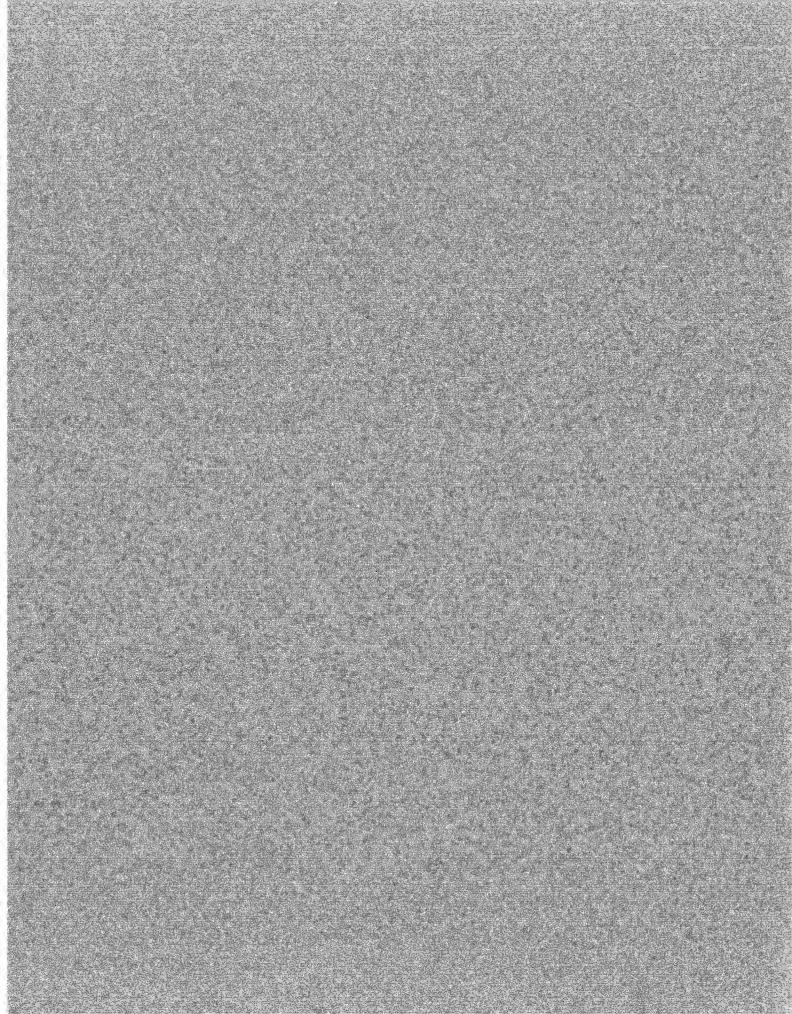
OWNER'S MANUAL

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80C DISASSEMBLER FOR THE COLOR COMPUTER

THE COLOR COMPUTER DISASSEMBLER FROM THE MICRO WORKS

The Color Computer Disassembler is a program which is designed to run in the Radio Shack Color Computer and to provide readable listings of machine-language programs in the memory of the computer. These listings may be displayed on the computer's screen or sent to a printer, and may be in any of several formats. The code to be disassembled may be resident in the computer or may be any 6809 code which is loaded into the computer's memory. This document describes the operation of the disassembler, and should enable you to quickly begin use of the program as well as allowing you later to understand and fully use the many options available.

This program is on a cassette tape which should be loaded with the CLOADM command. It will load starting at location $0600 and will wipe out any BASIC program that is there. BASIC should not be run after the tape is loaded; type EXEC to run the disassembler.

You will be prompted for a series of parameters, starting with "START ADDRESS". To get started, simply type a carriage return ("ENTER" key) in response to every question. In this program, all answers may be "defaulted" with a carriage return. After the last question, there will be a pause (for pass 1, the symbol table being built). When all the questions are defaulted, the entire BASIC ROM will be disassembled and pass 1 will take about 45 seconds. Then the listing will start.

To control the speed of the listing, the following keys may be used:
- Space bar will put the listing in single step mode; another key will put it back.
- Shift-@ will stop the listing as it does in BASIC.
- "S" will speed up and slow down the listing.
- BREAK key will allow the listing to be restarted at another address.

The question "RESTART WHERE?" will appear at the end of the listing or when BREAK is pressed. If it is defaulted (return is pressed) the program will restart from the beginning. Some of the questions which the program asks pertain to formatting and will be used often; some pertain to exactly what should be disassembled and will depend upon your application; still others are only for special cases and you may never need to answer them.

For all of your responses, your options are as follows:
  (1) You may default by simply pressing RETURN. All questions may be defaulted. When in doubt as to the meaning of a question, just press RETURN.
  (2) Addresses may be entered as a string of hex digits. If more than four digits are entered, the last four are used. Normal editing characters such as backspace are allowed.
  (3) Addresses may be entered in base ten by prefacing them with a period (eg. ",10" is the same as "A".)
  (4) Yes / No questions may be answered with "Y" or "YES" or "N" or "NO". Default (RETURN) is the same as NO.
  (5) The question "AREA OPTIONS" has a different format and is

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discussed below. When in doubt, default.
    (6) You may press the BREAK key. This will restart the program
        at the beginning.

The first question asks for an address at which to start disassem- *start*
bling, and the next for an address at which to stop. If these are *end*
both defaulted, you will be asked later if you want to default the
entire definition of what to disassemble (see below).

The next question asks for an offset to where the code can be found.
This is only used if some code has been copied to an address where *offset*
it does not ordinarily run, and is usually defaulted (which is the
same as a zero).

Next is the symbol table start and end address. This specifies some *symbol*
unused area of RAM which the program may use freely. The start and *table*
end default respectively to just after the end of the disassembler *location*
and 50 bytes below the stack. They only need to be entered if these
values will interfere with a program being disassembled.

Next is the area options, so we had best digress a little into the
idea behind them. A program is generally made up of machine code,
data tables, address tables, and so forth, all intermixed at the
discretion of whoever wrote the program. Since there is no reason why
data can't look like code, it is not possible for any disassembler to
automatically figure out the boundaries of these areas. The "AREA
OPTIONS" in this disassembler allow you to specify how to treat each
area within the block being disassembled.

Disassembly is normally a two-step process. First, you disassemble
the entire block treating everything as code. Certain blocks will
stand out as being data, and the ASCII column on the output will help
to identify text strings. You note a list of these areas and then
enter them to make a new listing which is much "cleaner". If a
perfect listing is desired, the new listing is studied at length until
a complete list of areas is discovered, and the disassembler is run
yet again.

The area types allowed by this program are as follows:
    P - program area (machine code)
    D - data area (FCB mnemonics)
    A - address area (FDB mnemonics)
    S - text string area (FCC mnemonics)
    V - variable area (RMB mnemonics - contents of memory ignored)
    T - table area (alternating FDB and FCB)
    E - end of last area

To enter an area, type the letter of the area type, a space, and an
address. For example, if there is data at addresses 4567 through
4568, type:
    D 4567   (data area starts at 4567)
    P 4569   (program area resumes at 4569, one byte past the
                     last data byte)
After the last option is entered, simply press RETURN.

The actual effect of entering a starting address (in answer to the
first question) is to have that address entered in the area table as
a "P" area. If that address is later specified as another type (or
if any area is respecified) the new definition simply takes the place
of the old one. The effect of entering an ending address (in answer
to the second question) is to have that entered as an "E" area.
When a RETURN is entered in response to the AREA OPTION question
(whether or not it is the first time it was asked) the program checks
that there are at least two boundaries specified, and if not the
question is repeated.

If nothing has been entered, however, you are given a choice of
copying the last set of areas used. The question is phrased so
that a NO or default answer will copy in the previous set of
areas. This table may then be added to. This is useful in building
a set of areas, and restarting the program whenever a new area
is discovered. If this option is used when the program is first
loaded, however, the default set of areas will be set to those
corresponding to the Level 1 BASIC interpreter ROM.

The remaining questions deal with the format of the output. You
may select the full output mode, the scan format, or the default
format. The full output takes two lines on the screen for each line
of generated source, but contains the complete output with reference
and cross reference addresses. If an 80-column printer is available,
it is recommended that this format be used. The scan format contains
the ASCII column and complete data columns at the expense of labels,
and is useful for determining where the various data and code areas
are. The default output mode gives only the first two bytes of the
hex value in order to make room for labels. Both the scan and default
format listings will fit in one line across the screen or across
a 32-column printer, and so will be half as long as the full listing.

The next question is whether or not to send the output to the printer.
Any printer that works with BASIC will work with the disassembler.
If the printer is requested, then you are asked if it is 80 columns.
Actually anything wider that 64 columns will work in 80-column mode.
For a narrow printer, the next question is: "NO CR ON COL 32?".
This is for the benefit of those printers which automatically produce
a carriage return / line feed on column 32 and for which the program-
generated carriage return would be redundant. If you type "NO" (or
default), and the listing contains unwanted blank lines, try typing
"YES" to this question next time.

The program now executes Pass 1. This will take anywhere from no
apparent time on a small disassembly to 45 seconds on the entire
BASIC ROM. When Pass 1 is complete, Pass 2 starts and the listing
will be produced.

When Pass 2 finishes, or is stopped by the BREAK key, it asks
where to restart. Any address may be given within the area covered by
Pass 1. If an address is given beyond the end of Pass 1 the question
will be repeated. If it is before Pass 1, however, the disassembler
will not object and will disassemble using the last area type it was
left in. This last feature allows the disassembler to be used like

a one pass disassembler by specifying a short Pass 1 at the top of
memory, then restarting wherever you want to disassemble. If you do
not give an address to the restart question, the whole program is
restarted.

The cross reference produced by the full format listing is used
to find every explicit reference to any address. It is used as
follows: Find the address of the label in question. Look it up in
the table at the end, which is sorted by address. (Labels within the
program are listed first, and externals listed separately.) The
number given after the address in that table is the address of the
last reference to that label. Now look at that reference. A number
given in the cross-reference column at that line will point to the
next prior reference, and so on. Four dots in the cross-reference
column indicates that that is the first reference to that address,
and is the end of the chain. A blank in the cross-reference column
indicates that that is the only reference to an address and saves
looking up the address in the table at the end.

While the listing is being generated, numeric keys may be pressed
to change listing modes. 1, 2, or 3 may be pressed to change into
Full, Scan, and Default modes respectively. 4, 5, and 6 may be
pressed to change into three more modes which are seldom used:
Source Only, Reference, and XReference; these are all one-line
modes which sacrifice various fields in order to include others
within the limited width of the screen.

Sometimes there is a reference to a label that is not on the first
byte of an instruction. This happens often when disassembling
a program where the data and variable areas are not known. It
also occurs in perfectly disassembled listings when the programmer
used such dirty tricks as using a Compare X Immediate opcode as
"Skip over two bytes" and following it with a two byte instruction.
There are two ways this disassembler deals with this. To increase
readability, it normally will set the program counter back so as to
disassemble the instruction at the label. This method, though nice,
is not correct in that the listing produced will not then reassemble
to the original code, and for this reason the "Source Only" format
causes it to print labels of the form:
    L1234 EQU *-1
In scan mode, where such backward referenced labels are mostly due
to lack of area specifications, they will also print as EQUs.

APPENDIX I: EXAMPLES OF THE DISASSEMBLER'S OUTPUT

THE FOLLOWING ARE EXAMPLES OF THE OUTPUT OF THE DISASSEMBLER.
THE THREE FORMATS ARE SHOWN. THE FULL FORMAT, WHICH TAKES
DOUBLE LINES ON A 32-COLUMN PRINTER, IS SHOWN PRINTED ON BOTH
A 32-COLUMN PRINTER AND AN 80-COLUMN PRINTER.

IN ADDITION, AN EXAMPLE IS GIVEN OF THE HEADER OUTPUT WHICH
IS PRINTED AT THE START OF LISTINGS. THIS INCLUDES NAM, ORG,
AND EQU STATEMENTS WHICH WOULD ALLOW THE DISASSEMBLY TO BE
REASSEMBLED.

```
        NAM   DISASM        HEADER WHICH ALLOWS REASSEMBLY OF OUTPUT
        ORG   $3000
X0000 EQU   $0000
X3119 EQU   $3119
X313C EQU   $313C
X3141 EQU   $3141
X31C1 EQU   $31C1
X33DC EQU   $33DC
X3C2A EQU   $3C2A
X3E5A EQU   $3E5A
X3EF5 EQU   $3EF5
X3EF9 EQU   $3EF9
X3F0A EQU   $3F0A            EXTERNAL EQUATES
X3F1C EQU   $3F1C
X3F35 EQU   $3F35
X3F36 EQU   $3F36
X4484 EQU   $4484
XCD00 EQU   $CD00
XD286 EQU   $D286
XD2B5 EQU   $D2B5
XD2C4 EQU   $D2C4
XD2C7 EQU   $D2C7
XD30F EQU   $D30F
XD312 EQU   $D312
```

FULL FORMAT, 80-COLUMN PRINTER

```
302C   BDD2C7   D2C7      =RG            JSR   XD2C7
302F   2502     3033      %.             BLO   L0004
3031   4F                 O              CLRA
3032   39                 9              RTS
3033   BDD2C4   D2C4      =RD    L0004   JSR   XD2C4        UN-DISASSEMBLABLE BYTES
3036   4D                 M              TSTA              ARE FLAGGED WITH "<<"
3037   39                 9              RTS
3038   01                 .              FCB   $01 <<
3039   2C10     304B      ,.             BGE   L0005
303A                             L0000   EQU   *-1          A LABEL ON THE SECOND
303B   FF3F36   3F36      .?6            STU   X3F36                BYTE OF INSTRUCTION
303E   BD3C2A   3C2A      =<*            JSR   X3C2A
3041   53                 S              COMB
3042   4F                 O              CLRA
3043   55                 U              FCB   $55 <<
3044   52                 R              FCB   $52 <<
3045   43                 C              COMA
```

TEXT STRINGS SHOW UP IN
THE ASCII COLUMN

"SCAN" FORMAT

HEX ADDRESS   HEX INSTRUCTION (UP TO 4 BYTES)

```
      A0B8 20F1      BRA   L0011        q
      A0BA 9F74     -STX   <V000C       . t
      A0BC 9F27      STX   <V000D       . '          ASCII EQUIVALENT (UP TO 2 BYTES);
      A0BE 9F23      STX   <V000E       . #          A "." INDICATES UNPRINTABLE
      A0C0 3089FF38 LEAX  XFF38,X       0.
      A0C4 9F21      STX   <V000F       . !
      A0C6 1F14      TFR   X,S          . .
```

A DASH INDICATES A LABEL

MNEMONIC   OPERAND

LABEL   DEFAULT FORMAT

```
      A093 AF48      STX   8,U
      A095 8E01+     LDX   #V0007
      A098 8639      LDA   #$39 "9"
      A09A A780 L000F STA  ,X+
      A09C 8C01+     CMPX  #V0008
      A09F 26F9      BNE   L000F
      A0A1 B702+     STA   V0009
      A0A4 8E06+     LDX   #V000A
      A0A7 6F80      CLR   ,X+
      A0A9 9F19      STX   <V000B
      A0AB A602 L0011 LDA  2,X
      A0AD 43        COMA
```

UP TO 2 BYTES OF HEX

A "+" INDICATES MORE THAN 2 BYTES

FULL FORMAT, NARROW PRINTER

```
      A0E0    9F72      0072 A01D    . r        ASCII EQUIVALENT (ALL 5 BYTES)
              STX   <V0002
      A0E2    8655                   . U
              LDA   #$55 "U"
      A0E4    9771      0071 A017    . q
              STA   <V0001
      A0E6    200B      A0F3         .
              BRA   L0015
      A0E8    12                     .
       L0014 NOP
      A0E9    0F6F      006F         . o          CROSS REFERENCE POINTER
              CLR   <V0013                         (LAST ADDRESS TO REFERENCE SAME ADDRESS)
      A0EB    BDAD33    AD33         =-3
              JSR  L0016
```
REFERENCED ADDRESS

LABEL   HEX INSTRUCTION (UP TO 5 BYTES)

HEX ADDRESS   6

APPENDIX II: A NOTE ON INTERFACING A PRINTER TO THE COLOR COMPUTER

As stated in the Disassembler manual, any printer that will work with
BASIC will work with the Disassembler.   Since there are some questions
involved in making a printer work with BASIC, however, this note is
included in hopes that we may be of some assistance.

All references to printers are to serial printers; at present there is
no easy way to interface to a parallel printer.

The serial input line must be pulled up (to a "break" condition) in
order for a printer to run.   This is because the Output Character
routine in the BASIC ROM checks this line after sending each character
and waits for it to be high.   This may be used to handshake with a
printer if it provides a signal which is high when ready to accept a
character.   If this is not needed, the daring may install a 10K pullup
resistor between this point (which may be found at the anode of CR6)
and +5.   (This resistor is large enough not to affect the operation
of this line as an input.)

The baud rate is set in locations $95 and $96.   It defaults to 600
baud.   It may be set using the Micro Works CBUG monitor, or by POKE
statements with the following values:

```
   110 baud- poke 149,1 : poke 150,202
   300 baud- poke 149,0 : poke 150,180
   600 baud- poke 149,0 : poke 150,87
  1200 baud- poke 149,0 : poke 150,41
  2400 baud- poke 149,0 : poke 150,18
```

Note that except for 110 baud, the byte at 149 (=$95) remains zero
and need not be set.

If the cable is used which plugs into the serial port and has a DB-25
connector on the other end, the following points should be noted:

   It is designed to plug into a modem.   This means that it transmits
   on pin 2 of the 25-pin connector, and receives from pin 3.   A
   printer will probably expect these two lines to be reversed; that
   is, the printer will listen on pin 3.

   Ground is on pin 7 as usual.

   The carrier-detect line goes to pin 8 and may be safely ignored.

An example of interfacing to a printer is given for the Malibu 165:

   Receive Data is expected on pin 3 of the printer's DB-25 connector,
   so this should be connected to the computer's Transmit line (or to
   pin 2 if the DB-25 cable is used).

   A positive-true Printer Buffer Not Full signal is available on pin
   20 of the printer's DB-25, and should be connected to the Receive
   line on the computer (or to pin 3 of the DB-25 cable).

   If the Buffer Not Full signal is not used, the computer's Receive
   line should be pulled up and the baud rate should not exceed 600
   (for this particular printer) so as not to overrun the printer's
   buffer.

APPENDIX III

MEMORY MAP OF THE COLOR COMPUTER:

```
0000-03FF   RAM USED BY BASIC INTERPRETER
0400-05FF   VIDEO DISPLAY (MAY BE MOVED)
0600-0FFF   RAM FOR USER PROGRAM
1000-3FFF   ADDITIONAL RAM IN 16K SYSTEM
4000-7FFF   NOT USED
8000-9FFF   EXPANSION ROM SLOT
A000-BFFF   BASIC INTERPRETER ROM
C000-FEFF   AVAILABLE TO CARTRIDGES
FF00-FFFF   I/O AND CONTROL; SEE BELOW
```

MEMORY MAP OF I/O AND CONTROL AREA:

```
FF00-FF1F   PIA 1 (ONLY 4 BYTES USED)
FF20-FF3F   PIA 2 (ONLY 4 BYTES USED)
FF40-FF5F   UNUSED (AVAILABLE TO CARTRIDGES FOR I/O)
FF60-FFBF   NOT USED
FFC0-FFDF   6883 REGISTERS (SEE BELOW)
FFE0-FFEF   NOT USED
FFF0-FFFF   RESTART VECTORS (ECHO FROM BFF0)
```

PIA 1 CONNECTIONS:

```
FF00   BITS 0-6   KEYBOARD ROW INPUT
       BIT  7     JOYSTICK COMPARISON INPUT
       BITS 0-1   ALSO CONNECTED TO JOYSTICK SWITCHES

FF01   PIA CONTROL REGISTER A
       CA1 IS 63.5 uSEC IRQ   <--
       CA2 IS OUTPUT TO LSB OF MUX

FF02   BITS 0-7   KEYBOARD COLUMN OUTPUT

FF03   PIA CONTROL REGISTER B
       CB1 IS 16.7 mSEC IRQ   <--
       CB2 IS OUTPUT TO MSB OF MUX
```

PIA 2 CONNECTIONS:

```
FF20   BIT  0     CASSETTE DATA INPUT
       BIT  1     RS232 DATA OUTPUT
       BITS 2-7   OUTPUT TO DAC

FF21   PIA CONTROL REGISTER A
       CA1 IS RS232 CARRIER DETECT FIRQ
       CA2 CASSETTE MOTOR CONTROL OUTPUT

FF22   BIT  0     RS232 DATA INPUT
       BIT  1     SINGLE BIT SOUND
       BIT  2     RAM SIZE JUMPER INPUT
       BIT  3     VDG CONTROL - "CSS"
       BIT  4     VDG CONTROL - "GM0" & "I/E"
       BIT  5     VDG CONTROL - "GM1"
       BIT  6     VDG CONTROL - "GM2"
       BIT  7     VDG CONTROL - "A/G"
```

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```
        FF23  PIA CONTROL REGISTER B
              CB1 IS CARTRIDGE FIRQ
              CB2 IS SOUND ENABLE OUTPUT
```

NOTE ON USING PIA CONTROL REGISTERS -
  WHEN WRITING TO A CONTROL REGISTER, ALWAYS SET BITS 2, 4, AND 5.
  SET BIT 0 TO ENABLE AN INTERRUPT FROM CA1 (OR CB1).
  SET BIT 1 TO LOOK FOR A RISING EDGE ON CA1 (OR CB1), OTHERWISE
      THE PIA WILL LOOK FOR A FALLING EDGE.
  SET BIT 3 TO TURN ON THE OUTPUT (CA2 OR CB2).
  WHEN READING, BIT 7 WILL BE SET IF AN EDGE HAS BEEN FOUND ON
      CA1 (OR CB1), AND WILL STAY SET UNTIL A READ IS DONE OF THE
      DATA REGISTER (THE BYTE BEFORE THE CONTROL REGISTER).

  EXAMPLES:

```
      LDA #$34      NO INTERRUPT, FALLING EDGE, CA2 OFF
      STA $FF21     CASSETTE MOTOR OFF
      LDA $FF21     GET CA1 FLAG
      BPL NERF      BRANCH UNLESS CARRIER DETECT HAS GONE HIGH TO LOW
      LDA $FF20     RESET CA1 TO LOOK FOR NEXT TRANSITION
```

THE DUAL 4-1 ANALOG MUX:

  THE TWO OUTPUTS CA2 AND CB2 FROM PIA 1 ARE USED TO CONTROL THE
  STATE OF AN ANALOG MULTIPLEXOR. ONE HALF OF THIS MUX DETERMINES
  WHICH SIGNAL GOES TO THE TELEVISION SOUND OUTPUT, AND THE OTHER
  HALF SELECTS WHICH JOYSTICK (AND WHETHER VERTICAL OR HORIZONTAL)
  IS TO BE COMPARED TO THE OUTPUT OF THE DAC.

FF01	FF03	SOUND OUT	JOYSTICK IN
34	34	6-BIT DAC	RIGHT HORIZONTAL
3C	34	FROM CASSETTE	RIGHT VERTICAL
34	3C	FROM CARTRIDGE	LEFT HORIZONTAL
3C	3C	NONE	LEFT VERTICAL

  NOTE THAT THERE WILL BE NO SOUND OUT ANYTIME CB2 OF PIA2
  (FF23 BIT 3) IS LOW. THIS IS THE SOUND ENABLE BIT. IT DOES
  NOT AFFECT THE JOYSTICK INPUTS.

LIST OF RESTART VECTORS:

```
      FFF0  NOT USED
      FFF2  SOFTWARE INT #3
      FFF4  SOFTWARE INT #2
      FFF6  FIRQ
      FFF8  IRQ
      FFFA  SOFTWARE INT #1
      FFFC  NONMASKABLE INT
      FFFE  RESET
```

REGISTERS IN THE 6883:

THESE REGISTERS ARE SET ONE BIT AT A TIME. A WRITE TO AN ODD
ADDRESS SETS A BIT, AND A WRITE TO AN EVEN ADDRESS CLEARS A
BIT. THE DATA WRITTEN IS IMMATERIAL. THE LOWEST ADDRESS IN
A GROUP AFFECTS THE LEAST SIGNIFICANT BIT OF THE REGISTER, AND
THE HIGHEST ADDRESS AFFECTS THE MOST SIGNIFICANT BIT.

```
    FFC0-FFC5   VIDEO DISPLAY MODE (NORMALLY 000)
    FFC6-FFD3   ADDRESS OF START OF DISPLAY (BY 1/2 K INCREMENTS)
    FFD4-FFD5   RAM BANK (NOT USED)
    FFD6-FFD9   MPU SPEED (NORMALLY 00 FOR 0.9 MHz)
    FFDA-FFDD   MEMORY SIZE
    FFDE-FFDF   MEMORY MAP TYPE (0 FOR ROM-BASED SYSTEM)
```

VIDEO DISPLAY GRAPHICS MODES:

6883 MODE BITS -->						V2	V1	V0
6847 CONTROL BITS -->	G/A	GM2	GM1	GM0	CSS			
INTERNAL ALPHANUMERICS	0	X	X	0	X	0	0	0
EXTERNAL ALPHANUMERICS	0	X	X	1	X	0	0	0
SEMIGRAPHICS - 4	0	X	X	0	X	0	0	0
SEMIGRAPHICS - 6	0	X	X	1	X	0	0	0
SEMIGRAPHICS - 8	0	X	X	0	X	0	1	0
SEMIGRAPHICS - 12	0	X	X	0	X	1	0	0
SEMIGRAPHICS - 24	0	X	X	0	X	1	1	0
FULL GRAPHICS - 1C	1	0	0	0	X	0	0	1
FULL GRAPHICS - 1R	1	0	0	1	X	0	0	1
FULL GRAPHICS - 2C	1	0	1	0	X	0	1	0
FULL GRAPHICS - 2R	1	0	1	1	X	0	1	1
FULL GRAPHICS - 3C	1	1	0	0	X	1	0	0
FULL GRAPHICS - 3R	1	1	0	1	X	1	0	1
FULL GRAPHICS - 6C	1	1	1	0	X	1	1	0
FULL GRAPHICS - 6R	1	1	1	1	X	1	1	0

APPENDIX IV

THE FOLLOWING IS A LIST CONTAINING SOME INTERESTING ADDRESSES IN
THE BASIC ROM. IT IS INTENDED TO AID IN THE UNDERSTANDING OF
DISASSEMBLY LISTINGS. IT IS NOT IN ANY WAY COMPLETE AND NO
REPRESENTATIONS ARE MADE AS TO ACCURACY OR APPLICABILITY. THE
ADDRESSES SHOWN MAY INDICATE THE BEGINNING OF A GENERAL AREA AS
OPPOSED TO ACTUAL ENTRY POINTS OF SUBROUTINES. CARE SHOULD BE
EXERCISED IN THE UTILIZATION OF INFORMATION IN THIS LIST.

```
A000    ADDRESS OF CHECK KEYBOARD
A002    ADDRESS OF CHARACTER OUT
A004    ADDRESS OF CASSETTE READ ON
A006    ADDRESS OF BLOCK IN
A008    ADDRESS OF BLOCK OUT
A00A    ADDRESS OF JOYSTICK IN
A00C    ADDRESS OF HEADER OUT
A00E    SECONDARY RESET
A027    PRIMARY RESET
A06E    HARDSTART (AFTER RESET)
A0E8    SOFTSTART (AFTER RESET)
A0F6    FIRQ ENTRY (ROM PACK CHECK)
A10D    START OF AREA DOWNLOADED TO RAM AT $8F
A129    START OF AREA DOWNLOADED TO RAM AT $10C
A170    INPUT CHARACTER, BIT 7 CLEAR
A176    INPUT CHARACTER
A199    BLINK CURSOR COLOR
A1C1    CHECK KEYBOARD AND GET KEY IF PRESSED
A26E    TABLE OF CODES FOR NON-ALPHA KEYS
A282    OUTPUT CHARACTER
A2BF    OUTPUT CHARACTER TO PRINTER (RS232)
A30A    OUTPUT CHARACTER TO SCREEN
A390    INPUT LINE FROM KEYBOARD
A416    CLOSE COMMAND
A44C    CSAVE COMMAND
A498    CLOAD COMMAND
A4FE    CLOADM COMMAND
A53E    EXEC COMMAND
A564    INKEY$ FUNCTION
A5CE    EOF FUNCTION
A5EC    SKIPF
A5F6    OPEN COMMAND
A701    READ BLOCK FROM TAPE
A70B    BLOCK IN
A7BD    MOTOR COMMAND
A85C    SINE TABLE FOR CASSETTE OUT
A880    SET COMMAND
A8B1    RESET COMMAND
A8F5    POINT FUNCTION
A910    CLS COMMAND
A937    PRINT COPYRIGHT (CLS 9)
A94B    SOUND COMMAND
A992    AUDIO COMMAND
A9B3    INTERRUPT PROCESSOR (60 HZ COUNTER)
A9C6    JOYSTICK
A9DE    READ JOYSTICK VALUES
AA29    FUNCTION ADDRESS TABLE
```

```
AA51   OPERATION TABLE FOR: + - * / ↑ AND OR
       (3 BYTES EACH: ADDRESSES AND PRECEDENCE VALUES)
AA66   COMMAND NAME TABLE
AB1A   FUNCTION NAME TABLE.
AB67   COMMAND ADDRESS TABLE
ABAF   ERROR CODE TABLE
ABE1   TEXT STRINGS
ABF9   SEARCH STACK FOR GOSUB OR FOR
AC1E   OPEN UP SPACE IN MEMORY
AC46   ERROR HANDLER
AC73   IDLE LOOP
AD17   NEW (CLEAR MEMORY)
AD47   FOR COMMAND
AD9E   INTERPRET LOOP
ADEB   CHECK FOR BREAK OR PAUSE
AE02   END COMMAND
AE09   STOP COMMAND
AE30   CONT COMMAND
AE41   CLEAR COMMAND
AE75   RUN COMMAND
AE86   GO COMMAND
AE92   GOSUB COMMAND
AEA4   GOTO COMMAND
AEC0   RETURN COMMAND
AEE2   REM, ELSE
AF14   IF COMMAND
AF42   ON COMMAND
AF67   GET UNSIGNED INTEGER
AF89   LET COMMAND
AFF5   INPUT
B046   READ
B0F8   NEXT COMMAND
B156   GET EXPRESSION
B1CB   ANOTHER ENTRY IN THE OPERATION TABLE
B223   GET OPERAND
B290   EXECUTE FUNCTIONS
B2D4   AND / OR OPERATIONS
B2F4   RELATIONAL OPERATIONS
B34E   DIM
B38F   VARIABLE CREATION
B3E4   EVALUATE INTEGER EXPRESSION
B4EE   MEM FUNCTION
B4FD   STR$ FUNCTION
B518   GET STRING
B681   LEN FUNCTION
B68C   CHR$ FUNCTION
B6A0   ASC FUNCTION
B6AB   LEFT$ FUNCTION
B6C8   RIGHT$ FUNCTION
B6CF   MID$ FUNCTION
B716   VAL FUNCTION
B750   PEEK FUNCTION
B757   POKE COMMAND
B75E   LLIST COMMAND
B764   LIST COMMAND
```

```
     B7E6   UNTOKENIZE
     B821   TOKENIZE
     B8F7   PRINT
     B97E   TAB
-->  B99C   PRINT TEXT STRING
     B9B4   START OF FLOATING POINT ROUTINES - ROUNDING
     B9B9   SUBTRACT FROM FPAC1
     B9C2   ADD TO FPAC1
     BA79   TWO'S COMPLEMENT FPAC1
     BAC5   CONSTANT 1.0
     BACA   MULTIPLY
     BB2F   MOVE [X] TO FPAC2
     BB7D   CONSTANT 10.0
     BB91   DIVIDE
     BC4A   MOVE FPAC2 TO FPAC1
     BC5F   MOVE FPAC1 TO FPAC2
     BC6D   TEST FPAC1 FOR ZERO AND SIGN
     BC7A   SGN FUNCTION
     BCEE   INT FUNCTION
     BD12   CONVERT STRING TO FLOATING POINT
     BDB6   CONSTANTS - 99999999.9. 999999999. 1E+09
     BDD9   CONVERT FPAC1 TO ASCII
     BEC0   CONSTANT 0.5
     BEC5   SERIES OF 4 BYTE CONSTANTS
     BF1F   RND FUNCTION
     BF78   SIN FUNCTION
     BFBD   CONSTANTS - 2 PI. 0.25
     BFC8   SERIES OF 5 BYTE CONSTANTS
     BFF0   RESTART VECTORS


     A FEW INTERESTING VARIABLES:

-->  0019   START OF USER RAM
     001B   TOP OF PGM. BEGIN VARIABLES
     001D   TOP OF VARIABLES
     001F   TOP OF ARRAYS
     0021   TOP OF STACK
     0025   MEMORY LIMIT FOR BASIC
     0027   PHYSICAL MEMORY LIMIT
-->  004F   FLOATING ACC #1 (6 BYTES)
-->  005C   FLOATING ACC #2 (6 BYTES)
     006F   DEVICE NUMBER FOR OUTPUT CHARACTER
     0071   RESET FLAG = $55 FOR WARMSTART
     0072   RESTART POINTER
     008F   START OF AREA DOWNLOADED FROM ROM
     0095   BAUD RATE FOR PRINTER (2 BYTES)
     0097   CR DELAY (2 BYTES)
     0098   COMMA FIELD WIDTH
     009A   PRINTER WIDTH
     009F   START OF GET NEXT CHARACTER SUBROUTINE
     010C   ANOTHER AREA DOWNLOADED FROM ROM
     015E   START OF TRAPS (3 BYTE SUBROUTINES WHICH
                              ARE SET TO RTS [$39])
-->  01DA   CASSETTE BUFFER
-->  02DD   INPUT BUFFER
```

0055 [handwritten: addr. of cursor]
0094 [handwritten: counter for cursor blink]

13

MEMORY MAP:

```
0000 -  03FF   VARIABLES, TEMPS, ETC.
0400 -  05FF   LO-RES SCREEN AREA
0600 -  ....   BASIC PROGRAM
               BASIC VARIABLES
               FREE MEMORY
               STACK
               STRINGS
         0FFF  TOP OF MEMORY ON 4K MACHINE
         3FFF  TOP OF MEMORY ON 16K MACHINE
4000 -  7FFF   UNUSED
8000 -  9FFF   EXTENDED BASIC ROM SOCKET
A000 -  BFFF   BASIC ROM
C000 -  FEFF   EXTERNAL ROM SLOT
FF00 -  FF03   KEYBOARD PIA
FF20 -  FF23   VDG / DAC PIA
FFC0 -  FFEF   SAM REGISTERS
FFF0 -  FFFF   RESTART VECTORS (FROM BFF0 - BFFF)
```

DISASSEMBLING THE EXTENDED BASIC ROM : APPENDIX V

THE EXTENDED BASIC ROM. WHICH IS LOCATED AT ADDRESSES 8000 THROUGH
9FFF. CAN BE DISASSEMBLED CLEANLY USING THE COMMANDS BELOW.

```
START ADDRESS: 0000
END ADDRESS: A000
ADDRESS OFFSET:
SYMBOL TABLE START:
SYMBOL TABLE END:
AREA OPTION: V 0000
AREA OPTION: D 8000
AREA OPTION: P 8002
AREA OPTION: D 80DC
AREA OPTION: S 80E8
AREA OPTION: P 813C
AREA OPTION: S 8183
AREA OPTION: A 81F0
AREA OPTION: S 821E
AREA OPTION: A 8257
AREA OPTION: P 8273
AREA OPTION: D 83AB
AREA OPTION: P 83B0
AREA OPTION: D 83E0
AREA OPTION: P 8446
AREA OPTION: D 84C4
AREA OPTION: P 84F2
AREA OPTION: S 890B
AREA OPTION: P 890F
AREA OPTION: S 8BD9
AREA OPTION: P 8BDD
AREA OPTION: A 929C
AREA OPTION: P 92A6
AREA OPTION: D 92DD
AREA OPTION: P 92E9
AREA OPTION: A 948A
AREA OPTION: P 9494
AREA OPTION: D 9706
AREA OPTION: P 9710
AREA OPTION: D 9839
AREA OPTION: P 9852
AREA OPTION: D 9C5B
AREA OPTION: P 9CB6
AREA OPTION: D 9E79
AREA OPTION: P 9E9D
AREA OPTION:
FULL OUTPUT? . . .
```

```
00002                              OPT     NOG
00003
00004                     ******************************
00005                     *                            *
00006                     *  GEN80 - DISASSEMBLER       *
00007                     *  ON TRS COLOR COMPUTER      *
00008                     *                            *
00009                     *  COPYRIGHT (c) 1981 BY      *
00010                     *  THE MICRO WORKS, INC.      *
00011                     *  WRITTEN BY ANDREW PHELPS   *
00012                     *  LAST REVISED: 29 MAR 81    *
00013                     *                            *
00014                     ******************************
00015
00016                     *  THIS PROGRAM GENERATES A SOURCE
00017                     *  LISTING FROM A BLOCK OF 6809 MACHINE
00018                     *  CODE.   INFORMATION ABOUT THE BOUNDARIES
00019                     *  OF TEXT STRINGS, VARIABLE AREAS, ETC.,
00020                     *  SUPPLIED BY THE OPERATOR, IS ENTERED
00021                     *  IN THE SYMBOL TABLE.  PASS 1 THEN
00022                     *  FILLS IN THE SYMBOL TABLE; PASS 2 LISTS
00023                     *  THE GENERATED SOURCE.   "SETMSK"
00024                     *  IS CALLED BEFORE PRINTING ANY FIELD
00025                     *  TO DETERMINE IF IT SHOULD BE PRINTED.
00026                     *  IN THE SYMBOL AREA, EXTERNALS GROW
00027                     *  BACK FROM THE END OF THE AREAS WHILE
00028                     *  LABELS GROW FROM THE BEGINNING.
00029
00030                     *
00031                     *  MACRO DEFINITIONS:
00032                     *
00033                     STRG    MACR              TERMINATED STRING
00034                       LBSR INDIS DISPLAY STRING
00035                       FCC "\0" INSERT STRING
00036                       IFEQ NARG-2 IF 2 ARGS
00037                         IFNC \1,RET
00038                           FAIL ILLEGAL STRING OPTION
00039                         ENDC
00040                         FCB $D ADD A CR
00041                       ENDC
00042                       FCB 0 TERMINATE STRING
00043                       ENDM
00044
00045                     T       MACR              TABLE ENTRY
00046                       FCC "\0"
00047                       FCB 0
00048                       FDB $\1,0
00049                       ENDM
00050
00051                     SETMSK MACR               CALL TO SET OUTMASK
00052                       LBSR SMASK
00053                       FCB \0
00054                       ENDM
00055
00056          0000    A TRS80   EQU     0          =0 FOR TRS80, =-1 FOR DOS
```

```
00058                        *
00059                        *   VARIABLES (ALL RELATIVE TO U REGISTER)
00060                        *
00061A 0000        0002    A FIRLAB RMB    2         POINTER TO LABEL AREA
00062A 0002        0002    A LASLAB RMB    2         LAST LABEL + 1
00063A 0004        0002    A CURLAB RMB    2         CURRENT PRINTED LABEL
00064A 0006        0002    A BOTEXT RMB    2         BOTTOM EXTERNAL ENTRY
00065A 0008        0002    A TOPEXT RMB    2         TOP EXTERNAL ENTRY
00066A 000A        0001    A LRESET RMB    1         1 => OLD LABELS PRESENT
00067A 000B        0002    A PAC    RMB    2         PC ADJUSTED FOR PREBYTE
00068A 000D        0002    A PRC    RMB    2         POINTER TO CODE
00069A 000F        0002    A REALPC RMB    2         POINTER TO WHERE CODE WOULD
00070A 0011        0001    A PASS   RMB    1         0 OR 1
00071A 0012        0002    A OFFSET RMB    2         PC-REALPC
00072A 0014        0001    A TFLAG  RMB    1         FOR T OPTION
00073A 0015        0001    A SSTEP  RMB    1         SINGLE STEP FLAG
00074A 0016        0001    A MODE   RMB    1         INSTRUCTION ADDRESS MODE
00075A 0017        0002    A LOOKXT RMB    2         X TEMP FOR LOOKUP
00076A 0019        0002    A MODADR RMB    2         ADDRESS OF MODE PROCESSOR
00077A 001B        0001    A LENGTH RMB    1         BYTES IN INSTRUCTION
00078A 001C        0001    A ALEN   RMB    1         LENGTH MINUS PREBYTE
00079A 001D        0001    A EXTRA  RMB    1         THE 4TH LETTER OF MNEMONIC
00080A 001E        0001    A MNENO  RMB    1         MNEMONIC NUMBER
00081A 001F        0002    A SAVEND RMB    2         USED IN STARTUP
00082A 0021        0002    A SAVSTR RMB    2         USED IN STARTUP
00083A 0023        0002    A LASREF RMB    2         LAST LINE REF SET BY REFERN
00084A 0025        0002    A CURMSK RMB    2         REQUESTED MASK
00085A 0027        0001    A NOCR32 RMB    1         1 => NO CR ON COL 32
00086A 0028        0001    A FULLMD RMB    1         1 => FULL PRINT MODE
00087A 0029        0001    A SCANMD RMB    1         1 => DON'T GO BACK ON EQU *-
00088A 002A        0001    A SLOW   RMB    1         $FF => PRINT DELAY
00089A 002B        0001    A SAVEIT RMB    1         1 => TO BUFFER ON OUTEE
00090A 002C        0001    A COL80  RMB    1         0 => NOT 80 COL
00091A 002D        0001    A PRINTR RMB    1         0 => TO SCREEN ONLY
00092A 002E        0001    A STARS  RMB    1         1 => DON'T PRINT HEX ADDR
00093A 002F        0002    A MASKF  RMB    2         PRINT FIELD MASK
00094A 0031        0001    A COLCNT RMB    1         LAST COLUMN PRINTED
00095A 0032        0001    A DIF    RMB    1         EQU *- VALUE
00096A 0033        0001    A ECFLAG RMB    1         <0 => SYMBOL USED > ONCE
00097A 0034        0002    A XT     RMB    2         TEMP
00098A 0036        0001    A INDFLG RMB    1         INDICATED INDIRECT MODES
00099A 0037        0001    A INDREG RMB    1         INDEX REGISTER (ASCII)
00100A 0038        0001    A DAREA  RMB    1         DATA AREA OR PROG
00101A 0039        0001    A TYPE   RMB    1         USED AT PARAMETER TIME
00102A 003A        0002    A XREFX  RMB    2         TEMP IN XREF
00103A 003C        0002    A REFX   RMB    2         LAST SYMBOL REFERENCED
00104A 003E        0001    A MODOP  RMB    1         PUSH S OR U FLAG
00105A 003F        0001    A CNT    RMB    1         COLUMN COUNTER IN XREF
00106
00107A 0040        0014    A LBF    RMB    20        OPERAND LINE BUFFER
00108              0054    A ENDLBF EQU    *
00109              0054    A NUMVAR EQU    *         TOTAL NUMBER OF VARIABLES
```

```
00111                            *
00112                            *    PROGRAM HEADERS AND LINKAGES
00113                            *
00114            0000     A          IFEQ    TRS80
00115A 0600                          ORG     $600
00116A 0600     0000     A          FDB     0            SO AS NOT TO
00117A 0602     0000     A          FDB     0            FREAK OUT BASIC ...
00118A 0604 20   11   0617          BRA     START
00119A 0606 6E   9F A002 A OUTCH    JMP     [$A002]      OUT CHARACTER TO SCREEN
00120A 060A 7E   A2BF    A OUTPRT   JMP     $A2BF        PRINT CHARACTER
00121A 060D 39              INTPRT  RTS                  NO PRINT INIT NEEDED
00122A 060E 7E   A390    A LINEIN   JMP     $A390        INPUT EDITED LINE
00123A 0611 6E   9F A000 A POLCAT   JMP     [$A000]      CHECK KEYBOARD
00124           02DD     A INBUF    EQU     $2DD         INPUT BUFFER ADDR
00125                                ENDC
00126
00127           0000     A          IFNE    TRS80
00163                                ENDC
00164
00165A 0615     012C     A SCON     FDB     300          SLOW SPEED CONSTANT
00166
00167                            *********************************************************
00168                            *
00169                            *    PROGRAM START
00170                            *
00171A 0617 32   E8 AC   A START    LEAS    -NUMVAR,S LEAVE ROOM FOR VARS
00172A 061A 1F   43      A          TFR     S,U          SAVE STACK FRAME PTR
00173A 061C                         STRG    (SOURCE   GEN 6809),RET
00174A 0630                         STRG    ((C)      1980 BY THE MICRO WORKS),RET
00175A 0650 30   8D 12D9            LEAX    PROEND,PCR
00176A 0654 AF   C4      A          STX     FIRLAB,U
00177A 0656 30   8D 13DB            LEAX    ENDDEF,PCR
00178A 065A AF   42      A          STX     LASLAB,U
00179A 065C 1F   34      A START1   TFR     U,S
00180A 065E 86   01      A          LDA     #1
00181A 0660 A7   4A      A          STA     LRESET,U LABELS NEED RESET
00182A 0662                         STRG    (START    ADDRESS? )
00183A 0675 17   0348 09C0          LBSR    ITYPE1
00184A 0678 26   03   067D          BNE     START2
00185A 067A 8E   FFFF    A          LDX     #$FFFF
00186A 067D AF   C8 21   A START2   STX     SAVSTR,U
00187A 0680                         STRG    (END      ADDRESS? )
00188A 0691 17   032C 09C0          LBSR    ITYPE1
00189A 0694 26   03   0699          BNE     START4
00190A 0696 8E   0000    A          LDX     #0
00191A 0699 AF   C8 1F   A START4   STX     SAVEND,U
00192A 069C                         STRG    (ADDRESS OFFSET? )
00193A 06B0 17   030D 09C0          LBSR    ITYPE1
00194A 06B3 26   03   06B8          BNE     START3
00195A 06B5 8E   0000    A          LDX     #0
00196A 06B8 AF   C8 12   A START3   STX     OFFSET,U
00197A 06BB                         STRG    (SYMBOL    TABLE START? )
00198A 06D3 17   02EA 09C0          LBSR    ITYPE1
00199A 06D6 26   04   06DC          BNE     START5
00200A 06D8 30   8D 1251            LEAX    PROEND,PCR
00201A 06DC AC   C4      A START5   CPX     FIRLAB,U
00202A 06DE 27   06   06E6          BEQ     START7
```

```
00203A 06E0 AF    C4       A          STX    FIRLAB.U
00204A 06E2 AF    42       A          STX    LASLAB.U
00205A 06E4 6F    4A       A          CLR    LRESET.U
00206A 06E6                  START7   STRG   (SYMBOL   TABLE END? )
00207A 06FC 17    02C1 09C0            LBSR   ITYPE1
00208A 06FF 26    03   0704            BNE    START6
00209A 0701 30    E8 CE    A           LEAX   -50.S      LEAVE ROOM FOR STACK
00210A 0704 AF    48       A START6    STX    TOPEXT.U   PUT TOP OF EXTERNALS
00211A 0706 AF    46       A           STX    BOTEXT.U   NO EXTS YET
00212A 0708 AE    C8 21    A           LDX    SAVSTR.U   WHERE WAS START
00213A 070B 8C    FFFF     A           CMPX   #$FFFF     DEFAULT?
00214A 070E 27    08   0718            BEQ    START8
00215A 0710 86    50       A           LDA    #'P        TYPE "PROGRAM"
00216A 0712 A7    C8 39    A           STA    TYPE.U
00217A 0715 17    00E5 07FD            LBSR   INSOPT     INSERT TO TABLE
00218A 0718 AE    C8 1F    A START8    LDX    SAVEND.U
00219A 071B 27    08   0725            BEQ    START9     WAS END DEFAULTED?
00220A 071D 86    45       A           LDA    #'E
00221A 071F A7    C8 39    A           STA    TYPE.U     TYPE "END"
00222A 0722 17    00D8 07FD            LBSR   INSOPT     PUT IN SYM TAB
00223A 0725 17    00EA 0812 START9     LBSR   CLEANT     CLEAN OUT SYMBOL TABLE
00224
00225                              *
00226                              *   LOOP TO READ AREA BOUNDARIES
00227                              *
00228A 0728                  OPT     STRG   (AREA      OPTION: )
00229A 0739 17    02C5 0A01            LBSR   ITYPE2     GET LETTER/NUMBER
00230A 073C 27    49   0787            BEQ    OPTCR      NO OPTION ENTERED
00231A 073E A6    C8 39    A           LDA    TYPE.U
00232A 0741 81    3F       A           CMPA   #'?        PRINT SYMBOL TABLE
00233A 0743 26    0D   0752            BNE    OPT2
00234A 0745 86    01       A           LDA    #1         PASS TWO
00235A 0747 A7    C8 11    A           STA    PASS.U     SO IT WILL PRINT
00236A 074A 17    00F5 0842            LBSR   SETCRT     OUTPUT TO CRT
00237A 074D 17    0226 0976            LBSR   PXREF      PRINT XREF TABLE
00238A 0750 20    D6   0728            BRA    OPT
00239A 0752 81    50       A OPT2      CMPA   #'P        PROGRAM
00240A 0754 27    2D   0783            BEQ    OPTI
00241A 0756 81    53       A           CMPA   #'S        STRING
00242A 0758 27    29   0783            BEQ    OPTI
00243A 075A 81    44       A           CMPA   #'D        DATA
00244A 075C 27    25   0783            BEQ    OPTI
00245A 075E 81    41       A           CMPA   #'A        ADDRESSES
00246A 0760 27    21   0783            BEQ    OPTI
00247A 0762 81    56       A           CMPA   #'V        VARIABLES
00248A 0764 27    1D   0783            BEQ    OPTI
00249A 0766 81    45       A           CMPA   #'E        END
00250A 0768 27    19   0783            BEQ    OPTI
00251A 076A 81    54       A           CMPA   #'T        TABLE
00252A 076C 27    15   0783            BEQ    OPTI
00253A 076E                          STRG   (ILLEGAL OPTION).RET
00254A 0781 20    A5   0728            BRA    OPT
00255                              *
00256A 0783 8D    78   07FD OPTI      BSR    INSOPT     INSERT IT
00257A 0785 20    A1   0728            BRA    OPT        LOOP
00258                              *
00259A 0787 6D    4A       A OPTCR    TST    LRESET.U
```

```
00260A 0789 26   32    07BD            BNE    OPTCR2
00261A 078B AE   42    A               LDX    LASLAB,U
00262A 078D 30   14    A               LEAX   -12,X      MUST BE TWO ENTRIES
00263A 078F AC   C4    A               CMPX   FIRLAB,U
00264A 0791 1024 00BC 0851             LBHS   INGO       OK; AT LEAST TWO
00265A 0795                            STRG   (MUST      HAVE AT LEAST START AND END)
00266A 07BA 16   FF6B 0728             LBRA   OPT        NO DEFAULT TO GO TO
00267A 07BD               OPTCR2 STRG   (NON-DEFAULT AREAS? )
00268A 07D4 17   0268 0A3F             LBSR   ITYPE3     YES-NO
00269A 07D7 1026 FF4D 0728             LBNE   OPT        IF YES
00270A 07DB 6F   4A    A               CLR    LRESET,U
00271A 07DD 8D   33    0812            BSR    CLEANT
00272A 07DF                            STRG   (ANY       OTHER AREAS? )
00273A 07F4 17   0248 0A3F             LBSR   ITYPE3     YES-NO
00274A 07F7 1026 FF2D 0728             LBNE   OPT        IF YES
00275A 07FB 20   54    0851            BRA    INGO
00276                            *
00277                            *   INSERT AREA OPTION INTO TABLE
00278                            *
00279A 07FD 6D   4A    A INSOPT TST    LRESET,U NEED TO RESET?
00280A 07FF 27   06    0807            BEQ    INSOP2   OK IF NOT
00281A 0801 EC   C4    A               LDD    FIRLAB,U START OF TABLE
00282A 0803 ED   42    A               STD    LASLAB,U IS NOW END TOO
00283A 0805 6F   4A    A               CLR    LRESET,U DON'T RESET AGAIN
00284A 0807 1F   10    A INSOP2 TFR    X,D
00285A 0809 17   064B 0E57             LBSR   LOOKLA   LOOK UP SYMBOL
00286A 080C A6   C8 39 A               LDA    TYPE,U   SET TO WHAT TYPE
00287A 080F A7   84    A               STA    0,X      PUT TYPE INTO TABLE
00288A 0811 39                         RTS
00289                            *
00290                            *   CLEAN OUT UNNEEDED SYMBOLS
00291                            *
00292A 0812 AE   48    A CLEANT LDX    TOPEXT,U
00293A 0814 AF   46    A               STX    BOTEXT,U
00294A 0816 AE   C4    A               LDX    FIRLAB,U
00295A 0818 1F   12    A               TFR    X,Y
00296A 081A 6F   C8 39 A               CLR    TYPE,U
00297A 081D 10AC 42    A CLEAN2 CMPY   LASLAB,U
00298A 0820 27   1D    083F            BEQ    CLEAN3
00299A 0822 EC   A4    A               LDD    0,Y
00300A 0824 84   7F    A               ANDA   #$7F     CLEAR FLAG BIT
00301A 0826 A7   A4    A               STA    0,Y
00302A 0828 A1   C8 39 A               CMPA   TYPE,U   SAME AS LAST TYPE?
00303A 082B 27   0E    083B            BEQ    CLEAN4
00304A 082D A7   C8 39 A               STA    TYPE,U   RECORD NEW TYPE
00305A 0830 ED   81    A               STD    ,X++     MOVE SYMBOL DOWN
00306A 0832 EC   22    A               LDD    2,Y
00307A 0834 ED   81    A               STD    ,X++
00308A 0836 CC   0000  A               LDD    #0
00309A 0839 ED   81    A               STD    ,X++     NO XREF
00310A 083B 31   26    A CLEAN4 LEAY   6,Y      MOVE POINTER UP
00311A 083D 20   DE    081D            BRA    CLEAN2
00312A 083F AF   42    A CLEAN3 STX    LASLAB,U SAVE END POINTER
00313A 0841 39                         RTS
00314                            *
00315                            *   SET PARAMETERS FOR CRT
00316                            *
```

```
00317A 0842 6F   C8 15    A SETCRT CLR    SSTEP.U   NOT SINGLE STEP
00318A 0845 6F   C8 2D    A        CLR    PRINTR.U  NOT TO PRINTER
00319A 0848 86   01       A        LDA    #1
00320A 084A A7   C8 27    A        STA    NOCR32.U  NO CR ON COL 32
00321A 084D 6F   C8 2C    A        CLR    COL80.U   NOT 80 COLUMNS
00322A 0850 39                     RTS
00323                          *
00324                          *  DECIDE ON OUTPUT FORMAT
00325                          *
00326A 0851 86   01       A INGO   LDA    #1
00327A 0853 A7   4A       A        STA    LRESET.U  LABELS NOW NEED RESET
00328A 0855 17   032A 0B82         LBSR   STFULL
00329A 0858                        STRG   (FULL     OUTPUT?)
00330A 0868 17   01D4 0A3F         LBSR   ITYPE3
00331A 086B 26   1B   0888         BNE    INGO3
00332A 086D 17   031D 0B8D         LBSR   STSCAN
00333A 0870                        STRG   (SCAN     FORMAT?)
00334A 0880 17   01BC 0A3F         LBSR   ITYPE3
00335A 0883 26   03   0888         BNE    INGO3
00336A 0885 17   030D 0B95         LBSR   STDEFL
00337                          *
00338                          *  DECIDE ON OUTPUT UNIT
00339                          *
00340A 0888 8D   B8   0842 INGO3   BSR    SETCRT
00341A 088A                        STRG   (TO       PRINTER? )
00342A 089A 17   01A2 0A3F         LBSR   ITYPE3    GET YES NO
00343            0000     A        IFEQ   TRS80
00344A 089D 27   43   08E2         BEQ    INGO2     IF NO. CR32 OK
00345                              ENDC
00346            0000     A        IFNE   TRS80
00348                              ENDC
00349A 089F 6C   C8 2D    A        INC    PRINTR.U
00350A 08A2 17   FD68 060D         LBSR   INTPRT    INIT PRINTER
00351A 08A5                        STRG   (80-COLUMN? )
00352A 08B4 17   0188 0A3F         LBSR   ITYPE3
00353A 08B7 27   08   08C1         BEQ    INGO4     IF NO
00354A 08B9 6C   C8 2C    A        INC    COL80.U
00355A 08BC 6F   C8 27    A        CLR    NOCR32.U
00356A 08BF 20   21   08E2         BRA    INGO2
00357A 08C1               INGO4    STRG   (NO       CR ON COL 32?)
00358A 08D5 6F   C8 27    A        CLR    NOCR32.U
00359A 08D8 17   0164 0A3F         LBSR   ITYPE3    GET YES NO
00360A 08DB 27   05   08E2         BEQ    INGO2
00361A 08DD 86   01       A        LDA    #1
00362A 08DF A7   C8 27    A        STA    NOCR32.U
00363            08E2     A INGO2   EQU    *
00364                          *
00365                          *  INIT FOR PASS ONE
00366                          *
00367A 08E2 AE   C4       A        LDX    FIRLAB.U
00368A 08E4 AF   44       A        STX    CURLAB.U
00369A 08E6 AE   02       A        LDX    2.X
00370A 08E8 AF   4F       A        STX    REALPC.U
00371A 08EA 6F   C8 11    A        CLR    PASS.U
00372A 08ED 17   0320 0C10         LBSR   DOPASS    BUILD SYMBOL TABLE
00373                          *
00374                          *  PRINT HEADING & EXTERNALS
```

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00375                              *
00376A 08F0 86   01      A         LDA    #1
00377A 08F2 A7   C8 11   A         STA    PASS.U
00378A 08F5 86   FF      A         LDA    #$FF      START AT SLOW SPEED
00379A 08F7 A7   C8 2A   A         STA    SLOW.U    AND COMPLEMENT ON "S"
00380A 08FA 6F   C8 2B   A         CLR    SAVEIT.U  PRINTING OK
00381A 08FD                        SETMSK 13
00382A 0901 17   08D4 11D8         LBSR   CRLF
00383A 0904 CC   0000    A         LDD    #0
00384A 0907 ED   4F      A         STD    REALPC.U
00385A 0909 17   0770 107C         LBSR   DATCOL
00386A 090C 17   03F3 0D02         LBSR   LABEL2    NULL LABEL
00387A 090F                        SETMSK 13
00388A 0913 17   08C6 11DC         LBSR   PDATAI
00389A 0916      4E      A         FCC    /NAM  DISASM/
00390A 0921      00      A         FCB    0
00391A 0922 17   08B3 11D8         LBSR   CRLF
00392A 0925 AE   C4      A         LDX    FIRLAB.U
00393A 0927 AE   02      A         LDX    2.X
00394A 0929 AF   4F      A         STX    REALPC.U
00395A 092B 17   074E 107C         LBSR   DATCOL    PRINT DATA COLUMNS
00396A 092E 17   03D1 0D02         LBSR   LABEL2    NULL LABEL
00397A 0931                        SETMSK 13
00398A 0935 17   08A4 11DC         LBSR   PDATAI
00399A 0938      4F      A         FCC    /ORG  $/
00400A 093E      00      A         FCB    0
00401A 093F 30   4F      A         LEAX   REALPC.U
00402A 0941 17   084B 118F         LBSR   OUTADR    ORG ADDRESS
00403A 0944 17   0891 11D8         LBSR   CRLF
00404A 0947 17   0350 0C9A         LBSR   EXTERN    PRINT LIST OF EXTERNALS
00405                              *
00406                              *   PASS TWO
00407                              *
00408A 094A AE   C4      A         LDX    FIRLAB.U
00409A 094C EC   02      A         LDD    2.X
00410A 094E ED   4F      A         STD    REALPC.U
00411A 0950 AE   C4      A DO2     LDX    FIRLAB.U
00412A 0952 AF   44      A         STX    CURLAB.U
00413A 0954 6F   C8 15   A         CLR    SSTEP.U   NOT SINGLE STEPPING
00414A 0957 6F   C8 2E   A         CLR    STARS.U   NOT BACKTRACK FIELD
00415A 095A 17   02B3 0C10         LBSR   DOPASS    DO PASS TWO
00416A 095D 17   071C 107C         LBSR   DATCOL    PRINT DATA FOR END STMT
00417A 0960 17   039F 0D02         LBSR   LABEL2    LEAVE LABEL BLANK
00418A 0963                        SETMSK 13         ALWAYS PRINT
00419A 0967 17   0872 11DC         LBSR   PDATAI    PRINT "END" STMT
00420A 096A      45      A         FCC    /END/
00421A 096D      00      A         FCB    0
00422A 096E 17   0867 11D8         LBSR   CRLF
00423A 0971 8D   03   0976         BSR    PXREF
00424A 0973 16   0266 0BDC         LBRA   RESTA
00425                              *
00426                              *   PRINT XREF TABLE
00427                              *
00428A 0976 AE   C4      A PXREF   LDX    FIRLAB.U
00429A 0978 AF   C8 3A   A         STX    XREFX.U
00430A 097B 86   04      A XREF1   LDA    #4        NUMBER OF COLS
00431A 097D 6D   C8 2C   A         TST    COL80.U
```

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00432A 0980 26    02    0984           BNE     XREF5
00433A 0982 86    02        A          LDA     #2
00434A 0984 A7    C8 3F     A XREF5     STA     CNT.U
00435A 0987 17    084E 11D8             LBSR    CRLF
00436A 098A 17    0163 0AF0 XREF2     LBSR    PASCHK    STEP/BREAK
00437A 098D AE    C8 3A     A          LDX     XREFX.U
00438A 0990 AC    42        A          CPX     LASLAB.U
00439A 0992 26    0A    099E           BNE     XREF3
00440A 0994 AE    46        A          LDX     BOTEXT.U
00441A 0996 AF    C8 3A     A          STX     XREFX.U
00442A 0999 17    083C 11D8            LBSR    CRLF
00443A 099C 20    DD    097B           BRA     XREF1
00444A 099E AC    48        A XREF3     CPX     TOPEXT.U
00445A 09A0 27    1B    09BD           BEQ     XREF4
00446A 09A2 17    0575 0F1A            LBSR    PRLAB     PRINT XREF LABEL NAME
00447A 09A5 17    07EB 1193            LBSR    OUTSP
00448A 09A8 AE    C8 3A     A          LDX     XREFX.U
00449A 09AB 30    04        A          LEAX    4,X
00450A 09AD 17    07DF 118F            LBSR    OUTADR    XREF TOP OF THREAD
00451A 09B0 AF    C8 3A     A          STX     XREFX.U
00452A 09B3 17    07D5 118B            LBSR    OUTSP2    PRINT 2 SPACES
00453A 09B6 6A    C8 3F     A          DEC     CNT.U
00454A 09B9 26    CF    098A           BNE     XREF2
00455A 09BB 20    BE    097B           BRA     XREF1
00456A 09BD 16    0818 11D8 XREF4     LBRA    CRLF
00457                          *
00458                          *   INPUT LINE AND PARSE
00459                          *
00460A 09C0 17    FC4B 060E ITYPE1    LBSR    LINEIN    $$$$
00461A 09C3 25    29    09EE           BCS     BRAK
00462A 09C5 8E    02DD      A          LDX     #INBUF
00463A 09C8 17    009C 0A67            LBSR    GNUM
00464A 09CB 26    02    09CF           BNE     IERR
00465A 09CD 5D                         TSTB
00466A 09CE 39              ITRTS     RTS
00467                          *
00468A 09CF              IERR     STRG    (ENTER    A NUMBER OR RETURN).RET
00469A 09EC 20    D2    09C0           BRA     ITYPE1
00470                          *
00471                          *   BREAK KEY ON INPUT
00472                          *
00473A 09EE              BRAK     STRG    (**       BREAK **).RET
00474A 09FE 16    FC5B 065C            LBRA    START1
00475                          *
00476                          *   GET AN AREA PARAMETER
00477                          *
00478A 0A01 17    FC0A 060E ITYPE2    LBSR    LINEIN    X $$$$
00479A 0A04 25    E8    09EE           BCS     BRAK      WAS THERE A BREAK?
00480A 0A06 8E    02DD      A          LDX     #INBUF
00481A 0A09 A6    80        A          LDA     .X+       GET FIRST CHAR
00482A 0A0B 27    C1    09CE           BEQ     ITRTS     NOTHING ON LINE
00483A 0A0D A7    C8 39     A          STA     TYPE.U
00484A 0A10 81    3F        A          CMPA    #'?       ASKING FOR TABLE DUMP?
00485A 0A12 27    51    0A65           BEQ     TYP3Y
00486A 0A14 A6    80        A          LDA     .X+       SECOND LETTER
00487A 0A16 81    20        A          CMPA    #$20      MUST BE SPACE
00488A 0A18 26    08    0A22           BNE     IERR2
```

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00489A  0A1A 8D   4B    0A67           BSR     GNUM      GET A NUMBER
00490A  0A1C 26   04    0A22           BNE     IERR2
00491A  0A1E 5D                        TSTB
00492A  0A1F 27   01    0A22           BEQ     IERR2
00493A  0A21 39                        RTS
00494                           *
00495A  0A22                    IERR2  STRG    (ENTER  IN FORM:  X $$$$),RET
00496A  0A3D 20   C2    0A01           BRA     ITYPE2
00497                           *
00498A  0A3F 17   FBCC  060E   ITYPE3  LBSR    LINEIN    YES/NO
00499A  0A42 25   AA    09EE           BCS     BRAK
00500A  0A44 B6   02DD   A             LDA     INBUF
00501A  0A47 27   1D    0A66           BEQ     TYP3R     DEFAULT?
00502A  0A49 81   59     A             CMPA    #'Y       WAS IT YES?
00503A  0A4B 27   18    0A65           BEQ     TYP3Y
00504A  0A4D 81   4E     A             CMPA    #'N       OR "NO"?
00505A  0A4F 27   13    0A64           BEQ     TYP3N
00506A  0A51                           STRG    (ENTER  Y OR N),RET
00507A  0A62 20   DB    0A3F           BRA     ITYPE3    TRY AGAIN
00508                           *
00509A  0A64 4F                 TYP3N  CLRA
00510A  0A65 4D                 TYP3Y  TSTA
00511A  0A66 39                 TYP3R  RTS
00512                           *
00513                           *   HEX AND DECIMAL INPUT
00514                           *
00515A  0A67 CC   0000   A GNUM LDD     #0
00516A  0A6A 34   06     A             PSHS    D         INITIALIZE TOTAL
00517A  0A6C A6   84     A             LDA     ,X        GET A CHARACTER
00518A  0A6E 81   2E     A             CMPA    #'.       DECIMAL INPUT?
00519A  0A70 27   30    0AA2           BEQ     GDEC
00520A  0A72 A6   80     A GNUM2       LDA     ,X+       GET A CHARACTER
00521A  0A74 81   30     A             CMPA    #'0
00522A  0A76 25   27    0A9F           BLO     GNUM3
00523A  0A78 81   39     A             CMPA    #'9
00524A  0A7A 23   0A    0A86           BLS     GNUM4
00525A  0A7C 81   41     A             CMPA    #'A
00526A  0A7E 25   1F    0A9F           BLO     GNUM3
00527A  0A80 81   46     A             CMPA    #'F
00528A  0A82 22   1B    0A9F           BHI     GNUM3
00529A  0A84 80   07     A             SUBA    #7
00530A  0A86 80   30     A GNUM4       SUBA    #'0       MAKE NUMERIC
00531A  0A88 68   61     A             ASL     1,S       SHIFT INTO TOTAL
00532A  0A8A 69   E4     A             ROL     0,S
00533A  0A8C 68   61     A             ASL     1,S
00534A  0A8E 69   E4     A             ROL     0,S
00535A  0A90 68   61     A             ASL     1,S
00536A  0A92 69   E4     A             ROL     0,S
00537A  0A94 68   61     A             ASL     1,S
00538A  0A96 69   E4     A             ROL     0,S
00539A  0A98 AB   61     A             ADDA    1,S
00540A  0A9A A7   61     A             STA     1,S
00541A  0A9C 5C                        INCB              COUNT CHARACTERS
00542A  0A9D 20   D3    0A72           BRA     GNUM2
00543                           *
00544A  0A9F 4D                 GNUM3  TSTA              LAST CHAR A RETURN?
00545A  0AA0 35   90     A             PULS    X,PC
```

```
00546                              *
00547                              *   DECIMAL
00548                              *
00549A 0AA2 30    01        A GDEC   LEAX    1,X        OVER THE "."
00550A 0AA4 A6    80        A GDEC2  LDA     ,X+
00551A 0AA6 81    30        A        CMPA    #'0
00552A 0AA8 25    27    0AD1         BLO     GDEC3
00553A 0AAA 81    39        A        CMPA    #'9
00554A 0AAC 22    23    0AD1         BHI     GDEC3
00555A 0AAE 80    30        A        SUBA    #'0
00556A 0AB0 34    06        A        PSHS    A,B
00557A 0AB2 C6    0A        A        LDB     #10        MULTIPLY LSB BY 10
00558A 0AB4 A6    63        A        LDA     2+1,S
00559A 0AB6 3D                       MUL
00560A 0AB7 E7    63        A        STB     2+1,S
00561A 0AB9 34    02        A        PSHS    A
00562A 0ABB C6    0A        A        LDB     #10        MULTIPLY MSB BY 10
00563A 0ABD A6    63        A        LDA     1+2+0,S
00564A 0ABF 3D                       MUL
00565A 0AC0 EB    E0        A        ADDB    ,S+
00566A 0AC2 E7    62        A        STB     2+0,S
00567A 0AC4 35    06        A        PULS    A,B
00568A 0AC6 AB    61        A        ADDA    1,S        ADD ON NEW DIGIT
00569A 0AC8 A7    61        A        STA     1,S
00570A 0ACA 24    02    0ACE         BCC     GDEC4
00571A 0ACC 6C    E4        A        INC     0,S        ADD CARRY
00572A 0ACE 5C               GDEC4   INCB
00573A 0ACF 20    D3    0AA4         BRA     GDEC2
00574                              *
00575A 0AD1 4D               GDEC3   TSTA
00576A 0AD2 35    90        A        PULS    X,PC
00577                              *
00578                              *   SET OUTPUT MASK
00579                              *
00580A 0AD4 34    16        A SMASK  PSHS    D,X        SAVE REGISTERS
00581A 0AD6 AE    64        A        LDX     4,S        RET ADR
00582A 0AD8 A6    80        A        LDA     ,X+        GET PARAMETER
00583A 0ADA 6F    64        A        CLR     4,S        USE RET ADR AS TEMP
00584A 0ADC 6F    65        A        CLR     5,S
00585A 0ADE 1A    01        A        SEC                FOR FIRST ROTATE
00586A 0AE0 69    65        A SMA2   ROL     5,S        MOVE THE BIT OVER
00587A 0AE2 69    64        A        ROL     4,S
00588A 0AE4 4A                       DECA               COUNT DOWN PARAMETER
00589A 0AE5 2A    F9    0AE0         BPL     SMA2
00590A 0AE7 EC    64        A        LDD     4,S        GET RESULT
00591A 0AE9 AF    64        A        STX     4,S        RESTORE NEW RET ADR
00592A 0AEB ED    C8 2F     A        STD     MASKF,U    SAVE THE NEW MASK
00593A 0AEE 35    96        A        PULS    D,X,PC     RESTORE & RETURN
00594                              *
00595                              *   PAUSE / BREAK CHECK
00596                              *
00597A 0AF0 A6    C8 15     A PASCHK LDA     SSTEP,U    ARE WE SINGLE STEP?
00598A 0AF3 26    11    0B06         BNE     PSTEP
00599A 0AF5 17    FB19 0611          LBSR    POLCAT     CHECK KEYBOARD
00600A 0AF8 27    07    0B01         BEQ     RTS3
00601A 0AFA 81    53        A        CMPA    #'S        SLOW DOWN?
00602A 0AFC 26    04    0B02         BNE     PSTEP2
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00603A 0AFE 63    C8 2A   A          COM    SLOW,U    TOGGLE SLOW FLAG
00604A 0B01 39                 RTS3  RTS
00605A 0B02 81    20      A PSTEP2 CMPA   #$20      SPACE (STEP)
00606A 0B04 26    4E   0B54       BNE    PBE2
00607A 0B06 6F    C8 15   A PSTEP  CLR    SSTEP,U   ELSE NOT SINGLE STEP
00608A 0B09 6D    C8 11   A        TST    PASS,U
00609A 0B0C 26    13   0B21       BNE    PSTEP3    IF PASS 2
00610A 0B0E                        STRG   (PASS     1 STOPPED),RET
00611A 0B21 17    FAED 0611 PSTEP3 LBSR   POLCAT    GET ANOTHER KEY
00612A 0B24 27    FB   0B21       BEQ    PSTEP3    (WAIT FOR IT)
00613A 0B26 81    03      A        CMPA   #3        BREAK
00614A 0B28 1027 0088 0BB4        LBEQ   BREAK
00615A 0B2C 81    13      A        CMPA   #$13      SHIFT-@
00616A 0B2E 27    09   0B39       BEQ    PBE
00617A 0B30 81    20      A        CMPA   #$20
00618A 0B32 26    3B   0B6F       BNE    PASOK2
00619A 0B34 A7    C8 15   A        STA    SSTEP,U   START SINGLE-STEP
00620A 0B37 20    48   0BB1       BRA    PASOK
00621                              *
00622A 0B39 A6    C8 11   A PBE    LDA    PASS,U
00623A 0B3C 26    11   0B4F       BNE    PBE5
00624A 0B3E                        STRG   (PASS     1 PAUSE),RET
00625A 0B4F 17    FABF 0611 PBE5  LBSR   POLCAT
00626A 0B52 27    FB   0B4F       BEQ    PBE5
00627A 0B54 81    03      A PBE2   CMPA   #3        BREAK
00628A 0B56 27    5C   0BB4       BEQ    BREAK
00629A 0B58 81    13      A        CMPA   #$13      SHIFT-@
00630A 0B5A 27    DD   0B39       BEQ    PBE
00631A 0B5C 80    31      A        SUBA   #'1       NUMBERS = MODES
00632A 0B5E 27    22   0B82       BEQ    STFULL    FULL MODE
00633A 0B60 4A                     DECA
00634A 0B61 27    2A   0B8D       BEQ    STSCAN    SCAN MODE
00635A 0B63 4A                     DECA
00636A 0B64 27    2F   0B95       BEQ    STDEFL    DEFAULT MODE
00637A 0B66 4A                     DECA
00638A 0B67 27    31   0B9A       BEQ    STREAS    REASSEMBLY MODE
00639A 0B69 4A                     DECA
00640A 0B6A 27    36   0BA2       BEQ    STXREF    XREF MODE
00641A 0B6C 4A                     DECA
00642A 0B6D 27    38   0BA7       BEQ    STREFX    REFERENCE MODE
00643A 0B6F A6    C8 11   A PASOK2 LDA   PASS,U
00644A 0B72 26    0D   0B81       BNE    PASOK
00645A 0B74                        STRG   (GOING...),RET
00646A 0B81 39                 PASOK  RTS
00647                              *
00648                              *   CHANGE FORMAT MODES
00649                              *
00650A 0B82 6F    C8 29   A STFULL CLR    SCANMD,U  FULL MODE
00651A 0B85 CC    77EF    A        LDD    #$77EF
00652A 0B88 A7    C8 28   A        STA    FULLMD,U
00653A 0B8B 20    23   0BB0       BRA    SEMODE
00654                              *
00655A 0B8D CC    A80D    A STSCAN LDD    #$A80D    SCAN MODE
00656A 0B90 A7    C8 29   A        STA    SCANMD,U
00657A 0B93 20    18   0BAD       BRA    SSMODE
00658                              *
00659A 0B95 CC    3015    A STDEFL LDD    #$3015    DEFAULT MODE
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00660A 0B98 20    10    0BAA           BRA     SCMODE
00661                                *
00662A 0B9A CC    3000     A STREAS LDD     #$3000      REASSEMBLY - NO DATA COLS
00663A 0B9D A7    C8 29    A        STA     SCANMD.U
00664A 0BA0 20    0B    0BAD        BRA     SSMODE
00665                                *
00666A 0BA2 CC    3041     A STXREF LDD     #$3041      XREF MODE
00667A 0BA5 20    03    0BAA        BRA     SCMODE
00668                                *
00669A 0BA7 CC    3060     A STREFX LDD     #$3060      REFERENCE MODE
00670A 0BAA 6F    C8 29    A SCMODE CLR     SCANMD.U
00671A 0BAD 6F    C8 28    A SSMODE CLR     FULLMD.U
00672A 0BB0 ED    C8 25    A SEMODE STD     CURMSK.U
00673A 0BB3 39                        RTS
00674                                *
00675                                *   BREAK KEY WHILE PRINTING
00676                                *
00677A 0BB4 A6    C8 11    A BREAK  LDA     PASS.U
00678A 0BB7 26    21    0BDA        BNE     P2B
00679A 0BB9                          STRG    (***      BREAK IN PASS ONE ***).RET
00680A 0BD7 16    FA82 065C          LBRA    START1
00681                                *
00682A 0BDA 32    64       A P2B    LEAS    4,S         RET FROM PASCHK & DOPASS
00683                                *
00684A 0BDC                 RESTA    STRG    (RESTART WHERE? )
00685A 0BEF 17    FDCE 09C0          LBSR    ITYPE1
00686A 0BF2 26    17    0C0B        BNE     P2B2
00687A 0BF4                          STRG    (***      RESTART ***).RET
00688A 0C08 16    FA51 065C          LBRA    START1
00689                                *
00690A 0C0B AF    4F       A P2B2   STX     REALPC.U
00691A 0C0D 16    FD40 0950          LBRA    DO2
00692
00693                                *
00694                                *   CONTROL LOOP TO DISASSEMBLE LINE
00695                                *
00696A 0C10 17    FEDD 0AF0 DOPASS LBSR    PASCHK      PAUSE/BREAK TEST
00697A 0C13 AE    44       A        LDX     CURLAB.U CURRENT LABEL
00698A 0C15 AC    42       A        CMPX    LASLAB.U END OF TABLE?
00699A 0C17 22    47    0C60        BHI     RTS2        LEAVE IF SO
00700A 0C19 EC    02       A        LDD     2,X         ADDRESS OF LABEL
00701A 0C1B A3    4F       A        SUBD    REALPC.U ARE WE THERE?
00702A 0C1D 22    14    0C33        BHI     DOPAS2
00703A 0C1F 6F    C8 14    A        CLR     TFLAG,U     IN CASE A "T" AREA
00704A 0C22 A6    84       A        LDA     X           GET TYPE
00705A 0C24 84    7F       A        ANDA    #$7F        MASK XREF BIT
00706A 0C26 A7    C8 38    A        STA     DAREA.U     NEW AREA TYPE
00707A 0C29 81    45       A        CMPA    #'E         TYPE "END"?
00708A 0C2B 27    33    0C60        BEQ     RTS2
00709A 0C2D EC    4F       A        LDD     REALPC.U
00710A 0C2F A3    02       A        SUBD    2.X         ARE WE PAST IT?
00711A 0C31 26    04    0C37        BNE     DOPAS5
00712A 0C33 8D    31    0C66 DOPAS2 BSR     DOLINE      DISASSEMBLE THE LINE
00713A 0C35 20    D9    0C10        BRA     DOPASS      AND LOOP
00714                                *
00715                                *   GONE PAST A LABEL - IGNORE IT?
00716                                *
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00717A 0C37 1083 0005   A DOPAS5 CMPD    #5        FAR PAST IT?
00718A 0C3B 25   06   0C43        BLO     DOPAS7
00719A 0C3D 30   06    A          LEAX    6,X       MOVE TO NEXT LABEL
00720A 0C3F AF   44    A          STX     CURLAB,U  NEW CURRENT LABEL
00721A 0C41 20   CD   0C10        BRA     DOPASS    AND FORGET IT
00722                           *
00723                           *   GONE PAST A LABEL - PRINT EXTRA LINE
00724                           *
00725A 0C43 6D   C8 29  A DOPAS7 TST     SCANMD,U
00726A 0C46 26   19   0C61        BNE     DOPAS1    DON'T GO BACK IN SCAN MODE
00727A 0C48 EC   4F    A          LDD     REALPC,U
00728A 0C4A 34   06    A          PSHS    D         SAVE PC
00729A 0C4C EC   02    A          LDD     2,X
00730A 0C4E ED   4F    A          STD     REALPC,U  MOVE PC BACK
00731A 0C50 86   01    A          LDA     #1
00732A 0C52 A7   C8 2E  A          STA     STARS,U   FLAG THE LINE
00733A 0C55 8D   0F   0C66        BSR     DOLINE    AND DO IT
00734A 0C57 35   06    A          PULS    D         RESTORE PC
00735A 0C59 ED   4F    A          STD     REALPC,U
00736A 0C5B 6F   C8 2E  A          CLR     STARS,U   CLEAR FLAG
00737A 0C5E 20   B0   0C10        BRA     DOPASS    AND LOOP
00738A 0C60 39               RTS2  RTS
00739                           *
00740A 0C61 17   03C6 102A DOPAS1 LBSR    EQUS      PRINT "EQU *-n"
00741A 0C64 20   AA   0C10        BRA     DOPASS    LOOP FOR NEXT LINE
00742                           *
00743                           *   DISASSEMBLE AS RMB, STRING, OR DATA/CODE
00744                           *
00745A 0C66 EC   4F    A DOLINE LDD     REALPC,U GET PC
00746A 0C68 E3   C8 12  A          ADDD    OFFSET,U  FORM ACTUAL ADDRESS
00747A 0C6B ED   4D    A          STD     PRC,U     SAVE IT
00748A 0C6D A6   C8 38  A          LDA     DAREA,U   CHECK FOR RMB AREA
00749A 0C70 81   56    A          CMPA    #'V       IS IT "VAR"S?
00750A 0C72 1027 00A0 0D16        LBEQ    RMB       IF SO, PRINT "RMB"
00751A 0C76 81   53    A          CMPA    #'S       IS IT A STRING
00752A 0C78 26   0F   0C89        BNE     DOPAS3
00753A 0C7A AE   4D    A          LDX     PRC,U
00754A 0C7C A6   84    A          LDA     0,X       GET THE CHARACTER
00755A 0C7E 81   20    A          CMPA    #$20      IT IT TEXT?
00756A 0C80 25   07   0C89        BLO     DOPAS3    DO FCB IF NOT
00757A 0C82 81   7F    A          CMPA    #$7F      OR IF TOO BIG
00758A 0C84 24   03   0C89        BHS     DOPAS3
00759A 0C86 16   015E 0DE7        LBRA    FCC       IF TEXT, DO FCC
00760                           *
00761                           *   NORMAL INSTRUCTION OR DATA
00762                           *
00763A 0C89 17   02D5 0F61 DOPAS3 LBSR    LOOKOP    FIND TYPE OF OPERATION
00764A 0C8C 17   0121 0DB0        LBSR    GENOPN    BUILD OPERAND OUTPUT
00765A 0C8F 17   03F3 1085        LBSR    PRDATC    PRINT DATA ROW
00766A 0C92 8D   4B   0CDF        BSR     LABEL     PRINT LABEL
00767A 0C94 17   00BA 0D51        LBSR    PRINTL    PRINT SOURCE OF LINE
00768A 0C97 16   01A1 0E3B        LBRA    BUMPPC    UPDATE PC AND RETURN
00769                           *
00770                           *   EXTERNAL LIST
00771                           *
00772A 0C9A EC   C8 25  A EXTERN LDD     CURMSK,U
00773A 0C9D 85   10    A          BITA    #$10      BIT 12 = LABEL
```

```
00774A OC9F 27   3D   OCDE        BEQ     EX2        FORGET IT IF NO LABELS
00775A OCA1 AE   46      A        LDX     BOTEXT,U
00776A OCA3 AF   C8 3A   A        STX     XREFX,U
00777A OCA6 17   FE47 0AF0 EX3    LBSR    PASCHK     CHECK STEP & BREAK
00778A OCA9 AE   C8 3A   A        LDX     XREFX,U
00779A OCAC AC   48      A        CPX     TOPEXT,U
00780A OCAE 27   2E   OCDE        BEQ     EX2        DONE?
00781A OCB0 AE   02      A        LDX     2,X
00782A OCB2 AF   4F      A        STX     REALPC,U
00783A OCB4 17   03C5 107C        LBSR    DATCOL     PRINT DATA COLUMNS
00784A OCB7 AE   C8 3A   A        LDX     XREFX,U
00785A OCBA                       SETMSK  13
00786A OCBE 17   0259 0F1A        LBSR    PRLAB      PRINT EXT SYMBOL
00787A OCC1 17   0518 11DC        LBSR    PDATAI
00788A OCC4      20      A        FCC     / EQU   $/
00789A OCCB      00      A        FCB     0
00790A OCCC AE   C8 3A   A        LDX     XREFX,U
00791A OCCF 30   02      A        LEAX    2,X
00792A OCD1 17   04BB 118F        LBSR    OUTADR     PRINT EXTERNAL ADDRESS
00793A OCD4 30   02      A        LEAX    2,X
00794A OCD6 AF   C8 3A   A        STX     XREFX,U
00795A OCD9 17   04FC 11D8        LBSR    CRLF
00796A OCDC 20   C8   OCA6        BRA     EX3
00797A OCDE 39              EX2   RTS
00798                         *
00799                         *   PRINT LABEL
00800                         *
00801A OCDF AE   44      A LABEL  LDX     CURLAB,U CURRENT LABEL
00802A OCE1 AE   02      A        LDX     2,X        ADDRESS OF LABEL
00803A OCE3 AC   4F      A        CPX     REALPC,U ARE WE THERE?
00804A OCE5 22   1B   OD02        BHI     LABEL2
00805A OCE7                       SETMSK  12
00806A OCEB AE   44      A        LDX     CURLAB,U CURRENT LABEL
00807A OCED 17   022A 0F1A        LBSR    PRLAB      PRINT LABEL
00808A OCF0 17   04A0 1193        LBSR    OUTSP      PRINT SPACE
00809A OCF3                       SETMSK  11
00810A OCF7 17   04D6 11D0        LBSR    OUTCHR     PRINT DASH IF NOT LABEL MODE
00811A OCFA      2D      A        FCC     "-"
00812A OCFB AE   44      A        LDX     CURLAB,U BUMP TO NEXT LABEL
00813A OCFD 30   06      A        LEAX    6,X
00814A OCFF AF   44      A        STX     CURLAB,U
00815A OD01 39                    RTS
00816                         *
00817                         *   DON'T PRINT LABEL
00818                         *
00819A OD02 17   04E5 11EA LABEL2 LBSR    PASS2C     ONLY ON PASS 2
00820A OD05                       SETMSK  12
00821A OD09 17   047B 1187        LBSR    OUTSP5     SPACE OVER LABEL FIELD
00822A OD0C 17   0484 1193        LBSR    OUTSP
00823A OD0F                       SETMSK  11
00824A OD13 16   047D 1193        LBRA    OUTSP      SPACE INSTEAD OF DASH
00825
00826                         *
00827                         *   PRINT RMB'S
00828                         *
00829A OD16 17   0363 107C RMB    LBSR    DATCOL     PRINT DATA COLUMNS
00830A OD19 8D   C4   OCDF        BSR     LABEL      PRINT THE LABEL
```

```
00831A OD1B                              SETMSK  13
00832A OD1F 17    04BA 11DC              LBSR    PDATAI  PRINT "RMB"
00833A OD22       52      A              FCC     /RMB /
00834A OD27       00      A              FCB     O
00835A OD28 AE    44      A              LDX     CURLAB.U
00836A OD2A EC    02      A              LDD     2,X      GET ADDRESS OF NEXT LABEL
00837A OD2C 1F    01      A              TFR     D,X
00838A OD2E A3    4F      A              SUBD    REALPC.U GET BYTES TO NEXT LABEL
00839A OD30 AF    4F      A              STX     REALPC.U UPDATE PC TO NEXT LAB
00840A OD32 1083 0009    A               CMPD    #9       MORE THAN SINGLE-DIGIT?
00841A OD36 22    09    OD41             BHI     RMB4
00842A OD38 1F    98      A              TFR     B,A
00843A OD3A 8B    30      A              ADDA    #$30     MAKE NUMBER ASCII
00844A OD3C 17    0456 1195              LBSR    OUTEE    PRINT IT
00845A OD3F 20    OD    OD4E             BRA     RMB5
00846A OD41 34    06      A RMB4         PSHS    D
00847A OD43 17    048A 11DO              LBSR    OUTCHR   PRINT $ FOR HEX
00848A OD46       24      A              FCC     '$'
00849A OD47 1F    41                     TSX
00850A OD49 17    0443 118F              LBSR    OUTADR   PRINT AS 4-DIGIT HEX
00851A OD4C 32    62      A              LEAS    2,S
00852A OD4E 16    0487 11D8 RMB5         LBRA    CRLF     NEW LINE AND LEAVE
00853                             *
00854                             *   PRINT SOURCE LINE
00855                             *
00856A OD51 17    0496 11EA PRINTL LBSR   PASS2C   ONLY ON PASS 2
00857A OD54 8D    33    OD89             BSR     PRIMNE   PRINT MNEMONIC
00858A OD56 6F    C8 52   A              CLR     LBF+18.U FORCE END-OF-STRING
00859A OD59 6D    C8 28   A              TST     FULLMD.U ROOM FOR WHOLE LINE?
00860A OD5C 26    03    OD61             BNE     PL2
00861A OD5E 6F    C8 4B   A              CLR     LBF+11.U END-OF-STR AFTER 11 CHARS
00862A OD61 30    C8 40   A PL2          LEAX    LBF.U
00863A OD64 17    047B 11E2              LBSR    PDATA    PRINT OPERAND FIELD
00864A OD67                              SETMSK  15
00865A OD6B 6D    C8 1C   A              TST     ALEN.U
00866A OD6E 27    12    OD82             BEQ     PL4
00867A OD70 AE    4B      A              LDX     PAC.U
00868A OD72 A6    80      A              LDA     ,X+
00869A OD74 17    03EC 1163              LBSR    OUTASC   PRINT ASCII EQUIVALENT
00870A OD77 A6    C8 1C   A              LDA     ALEN.U
00871A OD7A 4A                           DECA
00872A OD7B 27    05    OD82             BEQ     PL4
00873A OD7D A6    80      A              LDA     ,X+      GET NEXT BYTE
00874A OD7F 17    03E1 1163              LBSR    OUTASC   PRINT ASCII
00875A OD82                    PL4       SETMSK  13
00876A OD86 16    044F 11D8              LBRA    CRLF     NEW LINE AND LEAVE
00877                             *
00878                             *   PRINT MNEMONIC
00879                             *
00880A OD89                    PRIMNE SETMSK  13
00881A OD8D E6    C8 1E   A              LDB     MNENO.U  MNEMONIC NUMBER
00882A OD90 86    03      A              LDA     #3       THREE BYTES PER ENTRY
00883A OD92 3D                           MUL              FORM INDEX
00884A OD93 30    8D 09D4                LEAX    MNETAB.PCR
00885A OD97 30    8B      A              LEAX    D,X      FORM ABSOLUTE POINTER
00886A OD99 C6    03      A              LDB     #3       LENGTH OF MNEMONIC
00887A OD9B A6    80      A PRNTL2 LDA    ,X+      GET A CHARACTER
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```
00888A 0D9D 17   03F5 1195           LBSR   OUTEE    PRINT IT
00889A 0DA0 5A                       DECB
00890A 0DA1 26   F8   0D9B           BNE    PRNTL2   LOOP FOR THREE
00891A 0DA3 A6   C8 1D   A           LDA    EXTRA.U  4th CHARACTER?
00892A 0DA6 26   02   0DAA           BNE    PRNTL3
00893A 0DA8 86   20      A           LDA    #$20     ELSE A SPACE
00894A 0DAA 17   03E8 1195 PRNTL3 LBSR OUTEE    PRINT 4th CHARACTER
00895A 0DAD 16   03E3 1193           LBRA   OUTSP    SPACE AFTER MNEMONIC
00896                            *
00897                            *   GENERATE OPERAND FIELD
00898                            *
00899A 0DB0 86   20      A GENOPN LDA   #$20     CLEAR LINE BUFFER
00900A 0DB2 31   C8 40   A           LEAY   LBF.U
00901A 0DB5 34   20      A           PSHS   Y
00902A 0DB7 31   C8 54   A           LEAY   ENDLBF.U
00903A 0DBA A7   A2      A GENOP2 STA    ,-Y
00904A 0DBC 10AC E4      A           CMPY   0,S
00905A 0DBF 26   F9   0DBA           BNE    GENOP2
00906A 0DC1 32   62      A           LEAS   2,S
00907A 0DC3 A7   C8 2B   A           STA    SAVEIT,U SET NO OUTPUT
00908A 0DC6 A6   C8 36   A           LDA    INDFLG,U
00909A 0DC9 27   04   0DCF           BEQ    PRNTL4
00910A 0DCB 17   0402 11D0           LBSR   OUTCHR   PRINT INDIRECT BRKTS
00911A 0DCE      5B      A           FCB    '[
00912A 0DCF AE   C8 19   A PRNTL4 LDX    MODADR.U
00913A 0DD2 CC   0000    A           LDD    #0
00914A 0DD5 ED   C8 3C   A           STD    REFX.U
00915A 0DD8 AD   84      A           JSR    0,X      DO THE MODE ROUTINES
00916A 0DDA A6   C8 36   A           LDA    INDFLG,U
00917A 0DDD 27   04   0DE3           BEQ    PRNTL5
00918A 0DDF 17   03EE 11D0           LBSR   OUTCHR   END BRACKET INDIRECT
00919A 0DE2      5D      A           FCB    ']
00920A 0DE3 6F   C8 2B   A PRNTL5 CLR    SAVEIT.U RESTORE PRINTING
00921A 0DE6 39                       RTS
00922                            *
00923                            *   PRINT TEXT STRING
00924                            *
00925A 0DE7 17   0292 107C FCC     LBSR   DATCOL   PRINT DATA COLUMNS
00926A 0DEA 17   FEF2 0CDF           LBSR   LABEL    PRINT LABEL
00927A 0DED                          SETMSK 13
00928A 0DF1 17   03E8 11DC           LBSR   PDATAI   PRINT "FCC"
00929A 0DF4      46      A           FCC    /FCC /
00930A 0DF9      00      A           FCB    0
00931A 0DFA AE   44      A           LDX    CURLAB.U NEXT LABEL
00932A 0DFC EC   02      A           LDD    2,X      DON'T GO PAST THIS ADR
00933A 0DFE A3   4F      A           SUBD   REALPC,U MAX STRING SIZE
00934A 0E00 1083 0008    A           CMPD   #8       DON'T GO OVER 8
00935A 0E04 23   02   0E08           BLS    FCC2
00936A 0E06 C6   08      A           LDB    #8
00937A 0E08 6F   C8 1B   A FCC2    CLR    LENGTH,U
00938A 0E0B AE   4D      A           LDX    PRC.U    ACTUAL DATA ADDRESS
00939A 0E0D A6   80      A FCC3    LDA    ,X+      GET A BYTE
00940A 0E0F 81   20      A           CMPA   #$20     IS IT TEXT?
00941A 0E11 25   0A   0E1D           BLO    FCC4
00942A 0E13 81   7F      A           CMPA   #$7F
00943A 0E15 24   06   0E1D           BHS    FCC4
00944A 0E17 6C   C8 1B   A           INC    LENGTH,U ONE MORE IN LENGTH
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00945A OE1A 5A                        DECB                COUNT DOWN OUR 8
00946A OE1B 26   FO    OEOD           BNE    FCC3
00947A OE1D A6   C8 1B  A FCC4  LDA   LENGTH.U LENGTH OF FINAL STRING
00948A OE20 8B   30     A         ADDA    #'O         MAKE ASCII
00949A OE22 17   0370 1195        LBSR    OUTEE       PRINT IT
00950A OE25 17   03A8 11DO         LBSR   OUTCHR      AND A COMMA
00951A OE28      2C     A           FCC   ','
00952A OE29 AE   4D     A           LDX   PRC,U
00953A OE2B E6   C8 1B  A           LDB   LENGTH.U
00954A OE2E A6   80     A FCC5  LDA   ,X+         GET A CHARACTER
00955A OE30 17   0362 1195        LBSR   OUTEE       GUARANTEE PRINTABLE
00956A OE33 5A                        DECB                COUNT DOWN
00957A OE34 26   F8    OE2E           BNE    FCC5        AND LOOP
00958A OE36 8D   03    OE3B           BSR    BUMPPC
00959A OE38 16   039D 11D8            LBRA   CRLF
00960                              *
00961                              *   BUMP PC ADDRESS
00962                              *
00963A OE3B E6   C8 1B  A BUMPPC LDB   LENGTH.U LENGTH OF LAST INSTRUCTION
00964A OE3E 4F                        CLRA
00965A OE3F E3   4F     A         ADDD    REALPC.U ADD TO LAST PC
00966A OE41 24   03    OE46           BCC    BUMPP2
00967A OE43 CC   FFFF   A           LDD   #$FFFF      HANG AT END OF MEM
00968A OE46 ED   4F     A BUMPP2 STD   REALPC.U TO FORM NEW ONE
00969A OE48 39                        RTS
00970                              *
00971                              *   LOOK UP AND INSERT SYMBOL TO TABLE
00972                              *
00973A OE49 AE   C4     A LOOKUP LDX   FIRLAB.U
00974A OE4B 10A3 02     A         CMPD    2,X
00975A OE4E 25   78    OEC8           BLO    LOOKX
00976A OE50 AE   42     A           LDX   LASLAB.U
00977A OE52 10A3 1C     A         CMPD    2-6,X
00978A OE55 22   71    OEC8           BHI    LOOKX
00979                              *
00980                              *   INSERT TO LABEL TABLE (NOT EXT)
00981                              *
00982A OE57 AE   42     A LOOKLA LDX   LASLAB.U START AT END OF TABLE
00983A OE59 34   06     A           PSHS   D           SAVE WHAT LOOKING FOR
00984A OE5B AC   C4     A LOOKL7 CPX   FIRLAB.U DONE?
00985A OE5D 27   23    OE82           BEQ    LOOKL4
00986A OE5F 30   1A     A           LEAX  -6.X        MOVE TO NEXT LABEL
00987A OE61 10A3 02     A         CMPD    2,X         CHECK IT OUT
00988A OE64 25   F5    OE5B           BLO    LOOKL7      NOT THERE YET?
00989A OE66 27   71    OED9           BEQ    SETBIT      FOUND IT?
00990A OE68 30   06     A           LEAX  6,X         OVERSHOT
00991A OE6A AF   C8 34  A           STX   XT,U
00992A OE6D AE   42     A           LDX   LASLAB.U
00993A OE6F AC   C8 34  A LOOKL5 CPX   XT,U
00994A OE72 27   OE    OE82           BEQ    LOOKL4
00995A OE74 EC   83     A           LDD   ,--X        MOVE LABELS
00996A OE76 ED   06     A           STD   6.X
00997A OE78 EC   83     A           LDD   ,--X
00998A OE7A ED   06     A           STD   6.X
00999A OE7C EC   83     A           LDD   ,--X
01000A OE7E ED   06     A           STD   6.X
01001A OE80 20   ED    OE6F           BRA    LOOKL5
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01002A 0E82 EC   42       A LOOKL4 LDD     LASLAB,U END OF TABLE
01003A 0E84 C3   0006     A        ADDD    #6        BUMP BY ONE LABEL
01004A 0E87 ED   42       A        STD     LASLAB,U
01005A 0E89 A6   1A       A        LDA     -6,X
01006A 0E8B 84   7F       A        ANDA    #$7F
01007A 0E8D A7   84       A        STA     O,X
01008A 0E8F 35   06       A        PULS    D
01009
01010                          *
01011                          *  STORE NEW SYMBOL & CHECK OVERFLOW
01012                          *
01013A 0E91 ED   02       A LOOKL6 STD     2,X       SAVE ADDRESS
01014A 0E93 6F   04       A        CLR     4,X       NO XREF
01015A 0E95 6F   05       A        CLR     5,X
01016A 0E97 6F   01       A        CLR     1,X       NO BYTE 1
01017A 0E99 EC   42       A        LDD     LASLAB,U
01018A 0E9B 10A3 46       A        CMPD    BOTEXT,U
01019A 0E9E 24   06   0EA6         BHS     OVERR     TABLES RAN INTO EACH OTHER?
01020A 0EA0 AF   C8 17   A        STX     LOOKXT,U
01021A 0EA3 A6   84       A        LDA     O,X
01022A 0EA5 39                     RTS
01023A 0EA6              OVERR     STRG    (SYMBOL   TABLE OV.   N.E.R.F.),RET
01024A 0EC5 16   FB26 09EE         LBRA    BRAK      GO DO A BREAK
01025
01026                          *
01027                          *  LOOK UP EXTERNAL
01028                          *
01029A 0EC8 AE   48       A LOOKX  LDX     TOPEXT,U
01030A 0ECA AC   46       A LOOKX2 CPX     BOTEXT,U
01031A 0ECC 27   16   0EE4         BEQ     LOOKX3
01032A 0ECE 30   1A       A        LEAX    -6,X
01033A 0ED0 10A3 02       A        CMPD    2,X
01034A 0ED3 25   F5   0ECA         BLO     LOOKX2
01035A 0ED5 22   1D   0EF4         BHI     LOOKX4
01036A 0ED7 34   06       A        PSHS    D
01037A 0ED9 A6   84       A SETBIT LDA     O,X
01038A 0EDB A7   C8 33   A        STA     ECFLAG,U
01039A 0EDE 8A   80       A        ORA     #$80      BIT MEANS "SEEN BEFORE"
01040A 0EE0 A7   84       A        STA     O,X
01041A 0EE2 35   86       A        PULS    D,PC
01042A 0EE4 AE   46       A LOOKX3 LDX     BOTEXT,U
01043A 0EE6 30   1A       A        LEAX    -6,X
01044A 0EE8 AF   46       A        STX     BOTEXT,U
01045A 0EEA 34   02       A LOOKX6 PSHS    A
01046A 0EEC 86   58       A        LDA     #'X       TYPE "EXTERNAL"
01047A 0EEE A7   84       A        STA     O,X
01048A 0EF0 35   02       A        PULS    A
01049A 0EF2 20   9D   0E91         BRA     LOOKL6
01050                          *
01051                          *  MOVE EXTERNALS DOWN
01052                          *
01053A 0EF4 AF   C8 17   A LOOKX4 STX     LOOKXT,U
01054A 0EF7 AE   46       A        LDX     BOTEXT,U
01055A 0EF9 30   1A       A        LEAX    -6,X
01056A 0EFB AF   46       A        STX     BOTEXT,U
01057A 0EFD 34   06       A        PSHS    D
01058A 0EFF EC   06       A LOOKX5 LDD     6,X       MOVE THE DATA
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01059A OF01 ED    81       A         STD      ,X++
01060A OF03 AC    C8 17    A         CPX      LOOKXT,U
01061A OF06 26    F7    OEFF         BNE      LOOKX5
01062A OF08 35    06       A         PULS     D
01063A OFOA 20    DE    OEEA         BRA      LOOKX6
01064                            *
01065                            *   REFERENCE SYMBOL
01066                            *
01067                            *   ENTRIES - REFERN (D SET) AND PRLAB (X SET)
01068                            *
01069A OFOC 17    FF3A OE49 REFERN   LBSR     LOOKUP     FIND SYMBOL
01070A OFOF 17    02D8 11EA          LBSR     PASS2C     DON'T PRINT PASS 1
01071A OF12 EC    04       A         LDD      4,X
01072A OF14 ED    C8 23    A         STD      LASREF,U SAVE LAST REFERENCE
01073A OF17 AF    C8 3C    A         STX      REFX.U
01074A OF1A A6    84       A PRLAB   LDA      0,X        GET TYPE
01075A OF1C 84    7F       A         ANDA     #$7F       REMOVE FLAG BIT
01076A OF1E 17    0274 1195          LBSR     OUTEE      PRINT IT
01077A OF21 30    02       A         LEAX     2,X
01078A OF23 17    024B 1171          LBSR     OUTBYT     PRINT ADDRESS
01079A OF26 16    0248 1171          LBRA     OUTBYT
01080                            *
01081                            *   CHANGE MODE O TO INDEXED MODE 1..n
01082                            *
01083A OF29 AE    4B       A MODEO   LDX      PAC,U      GET OPCODE ADR
01084A OF2B A6    01       A         LDA      1,X        POSTBYTE
01085A OF2D 84    60       A         ANDA     #$60       REGISTER BITS
01086A OF2F 30    8D 0029            LEAX     XYUS-1,PCR REGISTER TABLE
01087A OF33 30    01          MODEO1  INX
01088A OF35 80    20       A         SUBA     #$20
01089A OF37 2A    FA    OF33         BPL      MODEO1     LOOP FOR MULTIPLY
01090A OF39 A6    84       A         LDA      X          GET THE ENTRY
01091A OF3B A7    C8 37    A         STA      INDREG.U SAVE IT
01092A OF3E AE    4B       A         LDX      PAC,U
01093A OF40 A6    01       A         LDA      1,X        GET POSTBYTE AGAIN
01094A OF42 2A    13    OF57         BPL      MODEO2     IF PLUS, 5-BIT MODE
01095A OF44 84    10       A         ANDA     #$10       INDIRECT BIT
01096A OF46 A7    C8 36    A         STA      INDFLG.U
01097A OF49 A6    01       A         LDA      1,X        GET IT ONCE MORE
01098A OF4B 84    1F       A         ANDA     #$1F       MODE TYPE BITS
01099A OF4D 30    8D 04AC            LEAX     PBTAB.PCR
01100A OF51 A6    86       A         LDA      A,X        GET MODE NUMBER
01101A OF53 A7    C8 16    A         STA      MODE.U     SAVE THE NEW MODE
01102A OF56 39                       RTS
01103A OF57 86    01       A MODEO2  LDA      #1
01104A OF59 A7    C8 16    A         STA      MODE.U     5-BIT MODE = #1
01105A OF5C 39                       RTS
01106                            *
01107A OF5D       58       A XYUS    FCC      /XYUS/
01108
01109                            *
01110                            *   LOOK UP OPCODE
01111                            *
01112A OF61 AE    4D       A LOOKOP  LDX      PRC.U
01113A OF63 AF    4B       A         STX      PAC.U      SET TO NO PREBYTE
01114A OF65 6F    C8 36    A         CLR      INDFLG.U NO INDIRECT YET
01115A OF68 6F    C8 1D    A         CLR      EXTRA.U    NO EXTRA LETTER YET
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01116A OF6B A6  C8 38   A          LDA     DAREA,U    DATA AREA?
01117A OF6E 81  53      A          CMPA    #'S
01118A OF70 27  OF   OF81          BEQ     ISAD       TREAT STRING AS FCB
01119A OF72 81  54      A          CMPA    #'T
01120A OF74 26  07   OF7D          BNE     NOTAT      NOT TABLE
01121A OF76 6D  C8 14   A          TST     TFLAG.U
01122A OF79 27  06   OF81          BEQ     ISAD       TREAT TABLE AS FCB
01123A OF7B 20  19   OF96          BRA     ISANA      OR AS FDB
01124                         *
01125A OF7D 81  44      A NOTAT     CMPA    #'D
01126A OF7F 26  11   OF92          BNE     NODA
01127A OF81 86  01      A ISAD      LDA     #1
01128A OF83 A7  C8 14   A          STA     TFLAG.U
01129A OF86 86  18      A          LDA     #DATMOD
01130A OF88 A7  C8 16   A          STA     MODE.U
01131A OF8B 86  50      A          LDA     #80        "FCB"
01132A OF8D A7  C8 1E   A          STA     MNENO,U    MNEMONIC NO.
01133A OF90 20  40   OFD2          BRA     NOTMO
01134                         *
01135A OF92 81  41      A NODA      CMPA    #'A
01136A OF94 26  OF   OFA5          BNE     NOD
01137A OF96 6F  C8 14   A ISANA     CLR     TFLAG.U
01138A OF99 86  1A      A          LDA     #ADDMOD
01139A OF9B A7  C8 16   A          STA     MODE,U
01140A OF9E 86  55      A          LDA     #85        FDB MNEMONIC
01141A OFA0 A7  C8 1E   A          STA     MNENO.U
01142A OFA3 20  2D   OFD2          BRA     NOTMO
01143                         *
01144A OFA5 A6  84      A NOD       LDA     X
01145A OFA7 81  10      A          CMPA    #$10       PREBYTE?
01146A OFA9 27  5B   1006          BEQ     OP10
01147A OFAB 81  11      A          CMPA    #$11       OTHER ONE?
01148A OFAD 26  06   OFB5          BNE     NO11
01149A OFAF 30  8D 094E            LEAX    BYTE11-4,PCR
01150A OFB3 20  55   100A          BRA     OP1011
01151A OFB5 C6  03      A NO11      LDB     #3
01152A OFB7 3D                      MUL
01153A OFB8 30  8D 04AF            LEAX    BIGTAB.PCR
01154A OFBC 30  8B      A          LEAX    D,X
01155A OFBE A6  84      A RTAB      LDA     0,X
01156A OFC0 A7  C8 1E   A          STA     MNENO.U    MNEMONIC NO.
01157A OFC3 A6  02      A          LDA     2,X
01158A OFC5 A7  C8 1D   A          STA     EXTRA,U    LETTER AT END
01159A OFC8 A6  01      A          LDA     1,X
01160A OFCA A7  C8 16   A          STA     MODE.U
01161A OFCD 26  03   OFD2          BNE     NOTMO
01162A OFCF 17  FF57 OF29          LBSR    MODEO
01163A OFD2 A6  C8 16   A NOTMO     LDA     MODE.U
01164A OFD5 81  19      A          CMPA    #ERMODE
01165A OFD7 26  OF   OFE8          BNE     NOTMO2
01166A OFD9 C6  50      A          LDB     #80        FDB MNEMONIC
01167A OFDB E7  C8 1E   A          STB     MNENO.U
01168A OFDE 6F  C8 36   A          CLR     INDFLG,U
01169A OFE1 6F  C8 1D   A          CLR     EXTRA.U
01170A OFE4 AE  4D      A          LDX     PRC.U
01171A OFE6 AF  4B      A          STX     PAC.U
01172A OFE8 4A                      NOTMO2 DECA
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01173A OFE9 C6   03       A        LDB    #3         THREE PER ENTRY
01174A OFEB 3D                     MUL
01175A OFEC 30   8D 042D           LEAX   MODTAB,PCR
01176A OFFO 30   8B       A        LEAX   D,X        FORM ADDRESS OF ENTRY
01177A OFF2 A6   02       A        LDA    2,X
01178A OFF4 A7   C8 1C    A        STA    ALEN,U
01179A OFF7 AB   4C       A        ADDA   PAC+1,U
01180A OFF9 AO   4E       A        SUBA   PRC+1,U
01181A OFFB A7   C8 1B    A        STA    LENGTH,U
01182A OFFE EC   84       A        LDD    0,X
01183A 1000 30   8B       A        LEAX   D,X
01184A 1002 AF   C8 19    A        STX    MODADR,U
01185A 1005 39                     RTS
01186                         *
01187                         *   FIND OPCODE AFTER PREBYTE
01188                         *
01189A 1006 30   8D 085F   OP10     LEAX   BYTE10-4,PCR
01190A 100A AF   C8 34    A OP1011  STX    XT,U
01191A 100D AE   4D       A        LDX    PRC,U
01192A 100F 30   01                INX               MOVE PAST PREBYTE
01193A 1011 AF   4B       A        STX    PAC,U
01194A 1013 A6   84       A        LDA    X
01195A 1015 AE   C8 34    A        LDX    XT,U
01196A 1018 30   04       A OP1012  LEAX   4,X        MOVE TO NEXT ENTRY
01197A 101A A1   84       A        CMPA   X          IS IT?
01198A 101C 22   FA     1018       BHI    OP1012     LOOP
01199A 101E 25   04     1024       BLO    OPNG       NOT THERE
01200A 1020 30   01                INX               POINT TO TABLE ENTRY
01201A 1022 20   9A     OFBE       BRA    RTAB       AND GO TREAT LIKE NORMAL
01202A 1024 30   8D 0473  OPNG     LEAX   *10*3+BIGTAB,PCR
01203A 1028 20   94     OFBE       BRA    RTAB
01204                         *
01205                         *   PRINT EQU *-n
01206                         *
01207A 102A AE   44       A EQUS     LDX    CURLAB,U
01208A 102C EC   4F       A        LDD    REALPC,U SAVE PC ON STACK
01209A 102E 34   06       A        PSHS   D
01210A 1030 A3   02       A        SUBD   2,X        CALCULATE DIFFERENCE
01211A 1032 E7   C8 32    A        STB    DIF,U
01212A 1035 AE   02       A        LDX    2,X
01213A 1037 AF   4F       A        STX    REALPC,U FAKE LAST PC
01214A 1039 8D   41     107C       BSR    DATCOL     PRINT DATA COLUMNS
01215A 103B 35   06       A        PULS   D
01216A 103D ED   4F       A        STD    REALPC,U RESTORE PC
01217A 103F 17   FC9D OCDF         LBSR   LABEL      PRINT LABEL
01218A 1042                        SETMSK 13
01219A 1046 17   0193 11DC         LBSR   PDATAI
01220A 1049        45    A         FCC    /EQU  *-/
01221A 1050        00    A         FCB    0
01222A 1051 A6   C8 32   A         LDA    DIF,U      GET DIFFERENCE
01223A 1054 8D   03     1059       BSR    OUTSM      OUTPUT SMALL NUMBER
01224A 1056 16   017F 11D8         LBRA   CRLF
01225                         *
01226                         *   OUTPUT SMALL NUMBER
01227                         *
01228A 1059 4D                OUTSM   TSTA
01229A 105A 2A   09     1065       BPL    OUTSM3     IS IT POSITIVE?
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01230A 105C 34    02                        PSHA
01231A 105E 17    016F 11D0                 LBSR    OUTCHR    PRINT MINUS SIGN
01232A 1061       2D      A                 FCB     '-
01233A 1062 35    02                        PULA
01234A 1064 40                              NEGA
01235A 1065 81    09      A  OUTSM3 CMPA     #9                SINGLE DIGIT?
01236A 1067 22    05    106E                BHI     OUTSM2
01237A 1069 8B    30      A                 ADDA    #*30      MAKE ASCII
01238A 106B 16    0127 1195                 LBRA    OUTEE
01239A 106E 34    02         OUTSM2 PSHA
01240A 1070 17    015D 11D0                 LBSR    OUTCHR    PRINT AS HEX
01241A 1073       24      A                 FCB     '$
01242A 1074 1F    41                        TSX
01243A 1076 17    00F8 1171                 LBSR    OUTBYT
01244A 1079 35    02                        PULA
01245A 107B 39                              RTS
01246
01247                      *********************************************
01248                      *
01249                      *   PRINT DATA LINE
01250                      *
01251A 107C 6F    C8 1B    A  DATCOL CLR     LENGTH,U
01252A 107F CC    0000     A         LDD     #0
01253A 1082 ED    C8 3C    A         STD     REFX,U
01254A 1085 17    0162 11EA PRDATC LBSR     PASS2C
01255A 1088                          SETMSK  0
01256A 108C 6D    C8 2E    A         TST     STARS,U   DO WE FLAG THIS LINE?
01257A 108F 26    07    1098         BNE     STARS1
01258A 1091 30    4F       A         LEAX    REALPC,U ADDRESS OF PC
01259A 1093 17    00F9 118F          LBSR    OUTADR    PRINT PC
01260A 1096 20    09    10A1         BRA     STARS2
01261A 1098 17    0141 11DC STARS1 LBSR     PDATAI    PRINT STARS INSTEAD
01262A 109B       2A       A         FCC     /**** /
01263A 10A0       00       A         FCB     0
01264             10A1     A  STARS2 EQU     *
01265                      *
01266                      *   PREBYTE
01267                      *
01268A 10A1                          SETMSK  1
01269A 10A5 A6    C8 1B    A         LDA     LENGTH,U
01270A 10A8 81    05       A         CMPA    #5        NEED PREBYTE FIELD?
01271A 10AA 25    07    10B3         BLO     FMT1
01272A 10AC AE    4D       A         LDX     PRC,U
01273A 10AE 17    00C0 1171          LBSR    OUTBYT    PRINT PREBYTE
01274A 10B1 20    03    10B6         BRA     FMT2
01275A 10B3 17    00D5 118B FMT1   LBSR     OUTSP2    ELSE SPACE OVER FIELD
01276             10B6     A  FMT2   EQU     *
01277                      *
01278                      *   HEX VALUE
01279                      *
01280A 10B6                          SETMSK  2
01281A 10BA E6    C8 1B    A         LDB     LENGTH,U
01282A 10BD AE    4D       A         LDX     PRC,U
01283A 10BF C1    05       A         CMPB    #5        PREBYTE ALREADY?
01284A 10C1 25    03    10C6         BLO     FMT3
01285A 10C3 30    01       A         INX               SKIP PREBYTE
01286A 10C5 5A                       DECB
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01287A 10C6 8D  OC    10D4 FMT3    BSR     BOS       PRINT BYTE OR SPACE
01288A 10C8 8D  OA    10D4         BSR     BOS       AND THE NEXT ONE
01289A 10CA                        SETMSK  3
01290A 10CE 8D  04    10D4         BSR     BOS       OTHERS IN MASK 3 ONLY
01291A 10D0 8D  02    10D4         BSR     BOS
01292A 10D2 20  OA    10DE         BRA     FMT4
01293                          *
01294                          *   ONE BYTE OR SPACE
01295                          *
01296A 10D4 5D               BOS    TSTB             LENGTH COUNT GONE?
01297A 10D5 2F  04    10DB         BLE     BOS2       PRINT SPACE IF SO
01298A 10D7 5A                     DECB              COUNT DOWN BYTES
01299A 10D8 16  0096 1171          LBRA    OUTBYT     PRINT THE BYTE
01300A 10DB 16  00AD 118B BOS2     LBRA    OUTSP2
01301                          *
01302                          *   HEX EXTRA MARKER
01303                          *
01304A 10DE                  FMT4   SETMSK  4
01305A 10E2 86  20    A             LDA     #$20
01306A 10E4 E6  C8 1B A             LDB     LENGTH,U LENGTH OF INSTR
01307A 10E7 C1  02    A             CMPB    #2       IF >2, DIDN'T FIT
01308A 10E9 2F  02    10ED          BLE     FMT5
01309A 10EB 86  2B    A             LDA     #'+      MARK LEFTOVERS
01310A 10ED 17  00A5 1195 FMT5      LBSR    OUTEE
01311                          *
01312                          *   REFERENCE ADDRESS
01313                          *
01314A 10F0                        SETMSK  8
01315A 10F4 17  009C 1193          LBSR    OUTSP
01316A 10F7                        SETMSK  5
01317A 10FB AE  C8 3C A             LDX     REFX,U
01318A 10FE 27  30    1130          BEQ     FMT6     NOT MEMORY REF?
01319A 1100 30  02    A             LEAX    2,X
01320A 1102 17  008A 118F          LBSR    OUTADR   PRINT ADDR OF LABEL
01321A 1105                        SETMSK  6
01322A 1109 AE  C8 23 A             LDX     LASREF,U
01323A 110C 27  07    1115          BEQ     FMT8
01324A 110E 30  C8 23 A             LEAX    LASREF,U POINT AT XREF
01325A 1111 8D  7C    118F          BSR     OUTADR   AND PRINT XREF COL
01326A 1113 20  12    1127          BRA     FMT9
01327A 1115 6D  C8 33 A FMT8        TST     ECFLAG,U END-OF-CHAIN?
01328A 1118 2A  OB    1125          BPL     FMT12
01329A 111A 17  00BF 11DC          LBSR    PDATAI
01330A 111D    2E     A             FCC     /.... /
01331A 1122    OO     A             FCB     O
01332A 1123 20  02    1127          BRA     FMT9
01333A 1125 8D  60    1187 FMT12    BSR     OUTSP5
01334A 1127 AE  C8 3C A FMT9        LDX     REFX,U
01335A 112A EC  4F    A             LDD     REALPC,U
01336A 112C ED  04    A             STD     4,X      SAVE NEW XREF
01337A 112E 20  08    1138          BRA     FMT7
01338A 1130 8D  55    1187 FMT6     BSR     OUTSP5
01339A 1132                        SETMSK  6
01340A 1136 8D  4F    1187          BSR     OUTSP5
01341         1138    A FMT7        EQU     *
01342                          *
01343                          *   FIVE CHARACTER ASCII
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01344                           *
01345A 1138                             SETMSK  7
01346A 113C 8D    55    1193            BSR     OUTSP
01347A 113E AE    4D     A              LDX     PRC,U
01348A 1140 5F                          CLRB
01349A 1141 86    20     A FMT10        LDA     #$20        SPACE IF PAST END
01350A 1143 E1    C8 1B  A              CMPB    LENGTH,U PAST END OF INSTR?
01351A 1146 2C    02    114A            BGE     FMT11
01352A 1148 A6    80     A              LDA     ,X+         GET MORE DATA IF THERE
01353A 114A 8D    17    1163 FMT11      BSR     OUTASC   PRINT IF PRINTABLE
01354A 114C 5C                          INCB
01355A 114D C1    05     A              CMPB    #5          END OF COLUMN?
01356A 114F 25    F0    1141            BLO     FMT10
01357                            *
01358A 1151 6D    C8 2C  A              TST     COL80,U DON'T CR ON 80 COLUMNS
01359A 1154 26    06    115C            BNE     FMT13
01360A 1156                             SETMSK  9           ONLY IN FULL MODE
01361A 115A 8D    7C    11D8            BSR     CRLF        CARRIAGE RETURN HERE
01362A 115C                      FMT13  SETMSK  10
01363A 1160 8D    31    1193            BSR     OUTSP
01364A 1162 39                          RTS
01365                            *
01366                            *   PRINT ASCII EQUIVALENT
01367                            *
01368A 1163 84    7F     A OUTASC ANDA    #$7F        FORGET PARITY
01369A 1165 81    7F     A              CMPA    #$7F        IS IT RUBOUT?
01370A 1167 27    04    116D            BEQ     OUTAS3
01371A 1169 81    20     A              CMPA    #$20        PRINTABLE?
01372A 116B 2C    02    116F            BGE     OUTAS2
01373A 116D 86    2E     A OUTAS3 LDA     #'.         USE PERIOD IF CAN'T PRINT
01374A 116F 20    24    1195 OUTAS2 BRA     OUTEE
01375
01376                            ***************************************************
01377                            *                                                 *
01378                            *   PRINTER OUTPUT UTILITY ROUTINES               *
01379                            *                                                 *
01380                            ***************************************************
01381
01382                            *
01383                            *   PRINT BYTE
01384                            *
01385A 1171 A6    84     A OUTBYT LDA     0,X
01386A 1173 47                          ASRA
01387A 1174 47                          ASRA
01388A 1175 47                          ASRA
01389A 1176 47                          ASRA
01390A 1177 8D    02    117B            BSR     OUTNY
01391A 1179 A6    80     A              LDA     ,X+
01392A 117B 84    0F     A OUTNY  ANDA    #$F
01393A 117D 81    09     A              CMPA    #9
01394A 117F 23    02    1183            BLS     OUTNY2
01395A 1181 8B    07     A              ADDA    #7
01396A 1183 8B    30     A OUTNY2 ADDA    #$30
01397A 1185 20    0E    1195            BRA     OUTEE
01398                            *
01399                            *   PRINT SPACES
01400                            *
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01401A 1187 8D  OA    1193 OUTSP5 BSR     OUTSP
01402A 1189 8D  OO    118B        BSR     OUTSP2
01403A 118B 8D  06    1193 OUTSP2 BSR     OUTSP
01404A 118D 20  04    1193        BRA     OUTSP
01405                           *
01406                           *   PRINT ADDRESS AND SPACE
01407                           *
01408A 118F 8D  EO    1171 OUTADR BSR     OUTBYT
01409A 1191 8D  DE    1171        BSR     OUTBYT
01410A 1193 86  20      A OUTSP  LDA     #$20
01411                           *       FALL THRU
01412                           *
01413                           *   OUTPUT ONE CHARACTER TO PRINTER
01414                           *
01415A 1195 8D  53    11EA OUTEE  BSR     PASS2C   DON'T PRINT 1ST PASS
01416A 1197 6D  C8 2B  A        TST     SAVEIT,U NOT PRINTING?
01417A 119A 26  31    11CD        BNE     TOY
01418A 119C 34  06      A        PSHS    D
01419A 119E EC  C8 2F  A        LDD     MASKF,U  FIELD MASK
01420A 11A1 A4  C8 25  A        ANDA    CURMSK,U IS THAT BIT SET IN CURRENT
01421A 11A4 26  03    11A9        BNE     OUTEE2
01422A 11A6 E4  C8 26  A        ANDB    CURMSK+1,U TRY OTHER BYTE
01423A 11A9 35  06      A OUTEE2 PULS    D
01424A 11AB 27  22    11CF        BEQ     OUTEE3   IF ZERO. DON'T PRINT
01425A 11AD 6C  C8 31  A        INC     COLCNT,U COUNT COLUMNS
01426A 11B0 81  OD      A        CMPA    #$D      CARRIAGE RETURN?
01427A 11B2 26  11    11C5        BNE     OUTEE4
01428A 11B4 A6  C8 31  A        LDA     COLCNT,U
01429A 11B7 6F  C8 31  A        CLR     COLCNT,U RESET COUNTER
01430A 11BA 81  21      A        CMPA    #33      AT END OF LINE?
01431A 11BC 26  05    11C3        BNE     OUTEE5
01432A 11BE 6D  C8 27  A        TST     NOCR32,U FORGET THE CR?
01433A 11C1 26  OC    11CF        BNE     OUTEE3
01434A 11C3 86  OD      A OUTEE5 LDA     #$D
01435A 11C5 6D  C8 2D  A OUTEE4 TST     PRINTR,U ARE WE PRINTING
01436A 11C8 27  2E    11F8        BEQ     TOUCH    TO SCREEN INSTEAD?
01437A 11CA 16  F43D 060A        LBRA    OUTPRT   TO RS232
01438                           *
01439                           *   SAVE CHARACTER IN BUFFER
01440                           *
01441A 11CD A7  AO      A TOY    STA     ,Y+
01442A 11CF 39            OUTEE3 RTS
01443                           *
01444                           *   OUTPUT ONE CHARACTER INLINE
01445                           *
01446A 11D0 35  10      A OUTCHR PULS    X
01447A 11D2 A6  80      A        LDA     ,X+      GET THE CHARACTER
01448A 11D4 8D  BF    1195        BSR     OUTEE    PRINT IT
01449A 11D6 6E  84      A        JMP     0,X      RETURN PAST PARAMETER
01450                           *
01451                           *   CARRIAGE RET / LINE FEED
01452                           *
01453A 11D8 86  OD      A CRLF   LDA     #$D      NOT HARD, IS IT
01454A 11DA 20  B9    1195        BRA     OUTEE
01455                           *
01456                           *   PRINT DATA TO PRINTER OR SCREEN
01457                           *
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01458A 11DC 35   10       A PDATAI PULS   X          USE RET ADDR AS PTR
01459A 11DE 8D   02   11E2         BSR    PDATA       PRINT IN-LINE DATA
01460A 11E0 6E   84       A        JMP    0,X         RETURN PAST STRING
01461                              *
01462A 11E2 A6   80       A PDATA  LDA    ,X+         GET A CHARACTER
01463A 11E4 27   0B   11F1         BEQ    PAS2C1      IF ZERO, LEAVE
01464A 11E6 8D   AD   1195         BSR    OUTEE       PRINT IT
01465A 11E8 20   F8   11E2         BRA    PDATA       AND LOOP
01466                              *
01467                              *   ONLY ON PASS 2
01468                              *
01469A 11EA 6D   C8 11    A PASS2C TST    PASS,U
01470A 11ED 26   02   11F1         BNE    PAS2C1
01471A 11EF 32   62       A        LEAS   2,S         PULL 1ST RET ADDR
01472A 11F1 39             PAS2C1 RTS
01473
01474                              *************************************************
01475                              *
01476                              *   DISPLAY TO SCREEN
01477                              *
01478A 11F2 AE   E1       A INDIS  LDX    ,S++        USE RETURN ADDRESS
01479A 11F4 8D   16   120C         BSR    DISPLA      AS STRING POINTER
01480A 11F6 6E   84       A        JMP    0,X         AND RETURN PAST STRING
01481                              *
01482A 11F8 6D   C8 2A    A TOUCH  TST    SLOW,U      ARE WE IN SLOW MODE?
01483A 11FB 27   0C   1209         BEQ    TOUCH3      IF NOT, GO AHEAD
01484A 11FD 34   10       A        PSHS   X
01485A 11FF AE   8D F412           LDX    SCON,PCR SLOW SPEED CONSTANT
01486A 1203 30   1F       TOUCH2   DEX                COUNT FOR DELAY
01487A 1205 26   FC   1203         BNE    TOUCH2
01488A 1207 35   10       A        PULS   X
01489A 1209 16   F3FA 0606 TOUCH3 LBRA   OUTCH
01490                              *
01491A 120C A6   80       A DISPLA LDA    ,X+         GET THE CHARACTER
01492A 120E 27   E1   11F1         BEQ    PAS2C1      END OF STRING?
01493A 1210 8D   E6   11F8         BSR    TOUCH       TO ROM ROUTINE
01494A 1212 20   F8   120C         BRA    DISPLA
01495
01496                              ***********************************************
01497                              *                                             *
01498                              *   CALCULATE ADDRESSING MODE OUTPUT          *
01499                              *                                             *
01500                              ***********************************************
01501
01502                              *
01503                              *   INDEXED ADDRESSING MODES
01504                              *
01505A 1214 AE   4B       A MODE1  LDX    PAC,U    5,R
01506A 1216 A6   01       A        LDA    1,X
01507A 1218 48             ASLA
01508A 1219 48             ASLA
01509A 121A 48             ASLA
01510A 121B 47             ASRA
01511A 121C 47             ASRA
01512A 121D 47             ASRA
01513A 121E 17   FE38 1059 MOD18  LBSR   OUTSM
01514A 1221 8D   AD   11D0 COMMAR BSR    OUTCHR
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01515A 1223      2C      A           FCB      ',
01516A 1224 A6   C8 37   A           LDA      INDREG,U
01517A 1227 16   FF6B 1195           LBRA     OUTEE
01518                          *
01519A 122A 8D   F5    1221 MODE2    BSR      COMMAR    ,R+
01520A 122C 86   2B      A MOD23     LDA      #'+
01521A 122E 16   FF64 1195           LBRA     OUTEE
01522                          *
01523A 1231 8D   F7    122A MODE3    BSR      MODE2     ,R++
01524A 1233 20   F7    122C          BRA      MOD23
01525                          *
01526A 1235 86   2C      A MODE4     LDA      #',
01527A 1237 17   FF5B 1195 MODE45   LBSR     OUTEE
01528A 123A 86   2D      A           LDA      #'-
01529A 123C 17   FF56 1195           LBSR     OUTEE
01530A 123F A6   C8 37   A           LDA      INDREG,U
01531A 1242 16   FF50 1195           LBRA     OUTEE
01532                          *
01533A 1245 86   2C      A MODE5     LDA      #',     ,--R
01534A 1247 17   FF4B 1195           LBSR     OUTEE
01535A 124A 86   2D      A           LDA      #'-
01536A 124C 20   E9    1237          BRA      MODE45
01537                          *
01538A 124E 86   30      A MODE6     LDA      #'0     0,R
01539A 1250 17   FF42 1195 MODE67   LBSR     OUTEE
01540A 1253 20   CC    1221          BRA      COMMAR
01541                          *
01542A 1255 86   42      A MODE7     LDA      #'B     B,R
01543A 1257 20   F7    1250          BRA      MODE67
01544                          *
01545A 1259 86   41      A MODE8     LDA      #'A     A,R
01546A 125B 20   F3    1250          BRA      MODE67
01547                          *
01548A 125D AE   4B      A MODE9     LDX      PAC,U   8,R
01549A 125F A6   02      A           LDA      2,X
01550A 1261 20   BB    121E          BRA      MOD18
01551                          *
01552A 1263 AE   4B      A MODE10    LDX      PAC,U   16,R
01553A 1265 EC   02      A           LDD      2,X
01554A 1267 17   FCA2 OFOC           LBSR     REFERN
01555A 126A 20   B5    1221          BRA      COMMAR
01556                          *
01557A 126C 86   44      A MODE11    LDA      #'D     D,R
01558A 126E 20   E0    1250          BRA      MODE67
01559                          *
01560A 1270 17   FF5D 11D0 MODE12   LBSR     OUTCHR
01561A 1273      3C      A           FCC      '<'
01562A 1274 AE   4B      A           LDX      PAC,U
01563A 1276 E6   02      A           LDB      2,X
01564A 1278 1D                       SEX
01565A 1279 E3   4F      A MOD24     ADDD     REALPC,U
01566A 127B EB   C8 1B   A           ADDB     LENGTH,U
01567A 127E 89   00      A           ADCA     #0
01568A 1280 8D   17    1299          BSR      TREFQ
01569A 1282 17   FF57 11DC           LBSR     PDATAI
01570A 1285      2C      A           FCC      /,PCR/
01571A 1289      00      A           FCB      0
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01572A 128A 39                          RTS
01573                          *
01574A 128B 17   FF42 11DO MODE13 LBSR   OUTCHR   16,PC
01575A 128E      3E     A          FCC    '>'
01576A 128F AE   4B     A          LDX    PAC,U
01577A 1291 EC   02     A          LDD    2,X
01578A 1293 20   E4     1279       BRA    MOD24
01579                          *
01580A 1295 AE   4B     A MODE14 LDX    PAC,U    [ABS IND]
01581A 1297 EC   02     A          LDD    2,X
01582A 1299 16   FC70 OFOC TREFQ  LBRA   REFERN
01583
01584                          *
01585                          *   NON-INDEXED ADDRESSING MODES
01586                          *
01587A 129C 39              MODE15 RTS                 INHERENT
01588                          *
01589A 129D AE   4B     A MODE16 LDX    PAC,U    PSH/PUL
01590A 129F A6   84     A          LDA    X
01591A 12A1 84   02     A          ANDA   #2
01592A 12A3 A7   C8 3E  A          STA    MODOP,U
01593A 12A6 6D   C8 28  A          TST    FULLMD,U
01594A 12A9 26   OF     12BA       BNE    MOD165
01595A 12AB A6   01     A          LDA    1,X
01596A 12AD 5F              CLRB
01597A 12AE 44              MOD164 LSRA
01598A 12AF C9   OO     A          ADCB   #O
01599A 12B1 4D              TSTA
01600A 12B2 26   FA     12AE       BNE    MOD164
01601A 12B4 C1   04     A          CMPB   #4
01602A 12B6 1022 0094 134E         LBHI   MODE21
01603A 12BA A6   01     A MOD165 LDA    1,X
01604A 12BC 27   32     12FO       BEQ    MODERR
01605A 12BE 30   8D 0112           LEAX   RLISTA-2,PCR
01606A 12C2 30   02     A MOD161 LEAX   2,X
01607A 12C4 44              LSRA
01608A 12C5 24   FB     12C2       BCC    MOD161
01609A 12C7 34   16     A          PSHS   D,X
01610A 12C9 EC   84     A          LDD    X
01611A 12CB 30   8B     A          LEAX   D,X
01612A 12CD A6   84     A          LDA    O,X
01613A 12CF 81   53     A          CMPA   #'S
01614A 12D1 26   09     12DC       BNE    MOD162
01615A 12D3 6D   C8 3E  A          TST    MODOP,U
01616A 12D6 26   04     12DC       BNE    MOD162
01617A 12D8 30   8D 011A           LEAX   REGUM,PCR
01618A 12DC 17   FF03 11E2 MOD162 LBSR   PDATA
01619A 12DF 35   16     A          PULS   X,D
01620A 12E1 4D              TSTA
01621A 12E2 27   OB     12EF       BEQ    MOD163
01622A 12E4 1F   89     A          TFR    A,B
01623A 12E6 86   2C     A          LDA    #',
01624A 12E8 17   FEAA 1195         LBSR   OUTEE
01625A 12EB 1F   98     A          TFR    B,A
01626A 12ED 20   D3     12C2       BRA    MOD161
01627A 12EF 39              MOD163 RTS
01628                          *
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01629A 12F0 8D    5C    134E MODERR BSR     MODE21    DEFAULT TO IMM
01630A 12F2 30    8D 00BD            LEAX    NOTMS.PCR NOT FLAGGED MESSAGE
01631A 12F6 16    FEE9 11E2          LBRA    PDATA
01632                           *
01633A 12F9 AE    4B     A MODE17 LDX     PAC.U     TFR/EXG
01634A 12FB A6    01     A          LDA     1,X
01635A 12FD 2A    02    1301        BPL     MOD171
01636A 12FF 88    08     A          EORA    #$8
01637A 1301 85    08     A MOD171 BITA    #8
01638A 1303 26    EB    12F0        BNE     MODERR
01639A 1305 A6    01     A          LDA     1,X
01640A 1307 47                      ASRA
01641A 1308 47                      ASRA
01642A 1309 47                      ASRA
01643A 130A 47                      ASRA
01644A 130B 8D    08    1315        BSR     PREGT
01645A 130D 17    FEC0 11D0          LBSR    OUTCHR
01646A 1310       2C     A          FCB     ',
01647A 1311 AE    4B     A          LDX     PAC.U
01648A 1313 A6    01     A          LDA     1,X
01649A 1315 84    OF     A PREGT  ANDA    #$F
01650A 1317 81    OB     A          CMPA    #$B
01651A 1319 22    D5    12F0        BHI     MODERR
01652A 131B 30    8D 009D            LEAX    RLISTB-2.PCR
01653A 131F 30    02     A MOD172 LEAX    2,X
01654A 1321 4A                      DECA
01655A 1322 2A    FB    131F        BPL     MOD172
01656A 1324 EC    84     A          LDD     X
01657A 1326 27    C8    12F0        BEQ     MODERR
01658A 1328 30    8B     A          LEAX    D,X
01659A 132A 16    FEB5 11E2          LBRA    PDATA
01660                           *
01661A 132D 17    FEA0 11D0 MODE18 LBSR    OUTCHR    DIRECT PAGE
01662A 1330       3C     A          FCB     '<
01663A 1331 AE    4B     A          LDX     PAC.U
01664A 1333 E6    01     A          LDB     1,X
01665A 1335 4F                      CLRA
01666A 1336 16    FBD3 0F0C          LBRA    REFERN
01667                           *
01668A 1339 AE    4B     A MODE19 LDX     PAC.U     RELATIVE
01669A 133B E6    01     A          LDB     1,X
01670A 133D 1D                      SEX
01671A 133E E3    4F     A MOD191 ADDD    REALPC,U
01672A 1340 EB    C8 1B  A          ADDB    LENGTH,U
01673A 1343 89    00     A          ADCA    #0
01674A 1345 16    FBC4 0F0C          LBRA    REFERN
01675                           *
01676A 1348 AE    4B     A MODE20 LDX     PAC.U     16-BIT RELATIVE
01677A 134A EC    01     A          LDD     1,X
01678A 134C 20    F0    133E        BRA     MOD191
01679                           *
01680A 134E 17    FE7F 11D0 MODE21 LBSR    OUTCHR    IMMEDIATE
01681A 1351       23     A          FCB     '#
01682A 1352 AE    4B     A          LDX     PAC.U
01683A 1354 A6    01     A          LDA     1,X
01684A 1356 2B    05    135D        BMI     MOD212
01685A 1358 17    FCFE 1059          LBSR    OUTSM
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01686A 135B 20   03   1360           BRA    MOD213
01687A 135D 17   FDOE 106E MOD212 LBSR    OUTSM2
01688A 1360 AE   4B     A MOD213 LDX    PAC,U
01689A 1362 A6   01     A           LDA    1,X
01690A 1364 81   20     A           CMPA   #$20
01691A 1366 2D   16   137E           BLT    RTS
01692A 1368 81   7F     A           CMPA   #$7F
01693A 136A 27   12   137E           BEQ    RTS
01694A 136C 17   FE24 1193           LBSR   OUTSP
01695A 136F 17   FE5E 11D0           LBSR   OUTCHR
01696A 1372      22     A           FCB    ' "
01697A 1373 AE   4B     A           LDX    PAC,U
01698A 1375 A6   01     A           LDA    1,X
01699A 1377 17   FE1B 1195           LBSR   OUTEE
01700A 137A 17   FE53 11D0           LBSR   OUTCHR
01701A 137D      22     A           FCB    ' "
01702A 137E 39              RTS    RTS
01703                         *
01704A 137F AE   4B     A MODE22 LDX    PAC,U      EXTENDED
01705A 1381 EC   01     A           LDD    1,X
01706A 1383 16   FB86 0F0C           LBRA   REFERN
01707                         *
01708A 1386 17   FE47 11D0 MODE23 LBSR    OUTCHR      16-BIT IMM
01709A 1389      23     A           FCB    '#
01710A 138A 20   F3   137F           BRA    MODE22
01711                         *
01712                         *   NON-INSTRUCTION ADDRESSING MODES
01713                         *
01714
01715A 138C AE   4D     A MODE24 LDX    PRC,U      NORMAL FCB
01716A 138E A6   84     A           LDA    X
01717A 1390 17   FCDB 106E           LBSR   OUTSM2      $xx
01718A 1393 84   7F     A           ANDA   #$7F
01719A 1395 27   E7   137E           BEQ    RTS
01720A 1397 81   20     A           CMPA   #$20
01721A 1399 23   E3   137E           BLS    RTS
01722A 139B 34   02     A           PSHS   A
01723A 139D 17   FDEB 118B           LBSR   OUTSP2
01724A 13A0 35   02     A           PULS   A
01725A 13A2 16   FDF0 1195           LBRA   OUTEE
01726                         *
01727A 13A5 AE   4D     A MODE25 LDX    PRC,U      ERROR FCB
01728A 13A7 A6   84     A           LDA    X
01729A 13A9 17   FCC2 106E           LBSR   OUTSM2
01730A 13AC 30   8D 0003           LEAX   NOTMS,PCR
01731A 13B0 16   FE2F 11E2           LBRA   PDATA
01732A 13B3      20     A NOTMS FCC    / <</
01733A 13B6      00     A           FCB    0
01734                         *
01735A 13B7 AE   4D     A MODE26 LDX    PRC,U      ADDRESS TABLE MODE
01736A 13B9 EC   84     A           LDD    0,X
01737A 13BB 16   FB4E 0F0C           LBRA   REFERN
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01739                              *
01740                              *    TABLES
01741                              *
01742A 13BE        003A       A RLISTB  FDB    REGDM-*
01743A 13C0        0030       A         FDB    REGXM-*
01744A 13C2        0030       A         FDB    REGYM-*
01745A 13C4        0032       A         FDB    REGUM-*
01746A 13C6        002E       A         FDB    REGSM-*
01747A 13C8        0032       A         FDB    REGPCM-*
01748A 13CA        0000       A         FDB    0
01749A 13CC        0000       A         FDB    0
01750A 13CE        001E       A         FDB    REGAM-*
01751A 13D0        001E       A         FDB    REGBM-*
01752A 13D2        0014       A         FDB    CCRM-*
01753A 13D4        0015       A         FDB    DPRM-*
01754                              *
01755A 13D6        0010       A RLISTA  FDB    CCRM-*
01756A 13D8        0014       A         FDB    REGAM-*
01757A 13DA        0014       A         FDB    REGBM-*
01758A 13DC        000D       A         FDB    DPRM-*
01759A 13DE        0012       A         FDB    REGXM-*
01760A 13E0        0012       A         FDB    REGYM-*
01761A 13E2        0012       A         FDB    REGSM-*
01762A 13E4        0016       A         FDB    REGPCM-*
01763                              *
01764A 13E6        43         A CCRM    FCC    /CC/
01765A 13E8        00         A         FCB    0
01766A 13E9        44         A DPRM    FCC    /DP/
01767A 13EB        00         A         FCB    0
01768A 13EC        41         A REGAM   FCB    'A,0
01769A 13EE        42         A REGBM   FCB    'B,0
01770A 13F0        58         A REGXM   FCB    'X,0
01771A 13F2        59         A REGYM   FCB    'Y,0
01772A 13F4        53         A REGSM   FCB    'S,0
01773A 13F6        55         A REGUM   FCB    'U,0
01774A 13F8        44         A REGDM   FCB    'D,0
01775A 13FA        50         A REGPCM  FCB    'P,'C,0
01776
01777                              *    END OF FIRST FILE
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